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Ethnographical Museums and Empire

IN a lecture delivered recently before a joint meeting of the Royal Society of Arts and the India Society by Mr. J. de La Valette (*see* NATURE, Dec. 25, p. 1108) attention was directed to the work of the museums of Holland in promoting the study of the indigenous cultures of the Dutch possessions in Indonesia, and their aim of making familiar to the Dutch people the conditions of native life in these remote parts of the world, for the administration of which they themselves are ultimately responsible. In its broader aspect the problem with which those who have organized these museums have been confronted is one obviously of special interest to Great Britain, where there is a like need for general understanding of alien peoples and cultures under one and the same *imperium*, but on a vastly extended scale.

Mr. de La Valette pointed out that in their method of approach to the problem of the arrangement and organization of an ethnographical museum demonstrating the mode of life of their dependencies, the Dutch are in harmony with the modern tendency towards a 'humanism' in anthropological studies, in which the various disciplines of the study of man—ethnology, physical anthropology, archæology, history and the like—set apart for academic purposes in the past, are once more brought together and focused on the study of a single integrated group or culture. Man, his works and his environment, are thus studied as a single and unified whole and not in water-tight compartments. Mr. de La Valette then went on to contrast with these methods the antiquated procedure, as he sees it, of the museums of Great Britain; he admitted that they are unrivalled in the extent and variety of their collections, but, he maintained, dominated by a Victorian tradition of specimen-collecting and a passion for classificatory arrangement, which sterilizes them of all life and meaning in relation to the cultural history of man in its specific manifestations.

In directing attention to the merits of this regional or unitary method of museum organization in ethnographical studies, in which the whole life of a group is displayed as a rounded whole, Mr. de La Valette raised a question to which in its wide ramifications it is difficult to set limits of discussion. He was also in the strong tactical position of addressing an audience the interests of which in the main were directed to a single area, India—which is none the less concentrated though it is a sub-continent comprising not one but many ethnic, cultural and regional units. On the general question, however, this much may be said. In so far as the aim of the Dutch museums has been to bring home to their people an understanding of the life of their subject populations by intensive illustration, it is in accord with anthropological opinion in Great Britain, where the advantage to the British people of an ethnographical museum demonstrating the life and modes of thought of the peoples of alien culture of the dominions and dependencies has long been urged. Close on forty years ago Mr. (later Sir) Hercules Read, keeper of the Ethnographical Department of the British Museum, advocated in the strongest terms the establishment of an Imperial Bureau of Anthropology in connexion with his department, and time and again since then the need of an imperial ethnographical museum has been urged as the best, if perhaps not the only, means of promoting an educated interest among the general public in our dependent and fellow-subjects of culture other than our own.

While it is probable that there would be no two opinions as to the desirability, not to say the

urgency, of establishing an imperial ethnographical museum, the choice of method of arrangement and organization is not without its difficulties. There can be no question that in so far as these should be determined by the instructional aim, the regional and unitary method of display is ideal. Practical considerations, however, have to be taken into account; and whereas in Holland the problem has proved open to solution, in dealing with the native peoples of the British Empire provision would have to be made for a very different set of conditions. The Dutch possessions in Indonesia cover an environment limited in range; the cultures and ethnic groups relatively are neither numerous nor on the whole widely diverse in character. In the British dominions, on the other hand, the range in environment, in ethnic and cultural contrast, is world-wide. As a concrete proposal a scheme of intensive display, such as has been introduced in Holland, on a scale commensurate to the British Empire, would be wrecked at its inception by financial considerations alone. On the other hand, there is no adequate reason why certain larger units such as Africa and India, which lend themselves to a modified unitary treatment, should not receive special consideration and be the subject of intensive display.

Curators of existing collections in Great Britain will no doubt have received Mr. de La Valette's criticisms with very mixed feelings. They themselves are their sternest critics, and not all are wedded to tradition. But the museum curator, perhaps more than any other research worker, is firmly circumscribed by conditions; and the history and character of the collections, as well as the space available, limit the freedom with which problems in display may be solved.

Notwithstanding the aspersion of specimen-collecting cast upon our museums, it must be remembered that many of the exhibits are of historic interest in themselves as commemorative of early exploration, and could not be withdrawn from exhibition without loss of interest. Such, for example, are many exhibits from the Pacific in the British Museum, especially those acquired by Capt. Cook, or some of the early material from America. This brings us to the most serious point in Mr. de La Valette's indictment of museum policy in Great Britain. He alludes to a proposal to break up and distribute among other institutions in South Kensington the collections which, as the Indian Museum, form part of the Victoria and Albert Museum. These collections have as their nucleus the historic collection which belonged to the Honourable East India Company, a collection which embodies a stirring page in British history. Becoming the property of the Government after the Mutiny, it was transferred in 1870 to the Science and Art Department, later absorbed in the Board of Education when that body was formed. It thus became part of the Victoria and Albert Museum. Recently, under a new curator, Mr. K. de B. Codrington, the collections have undergone, or rather are undergoing, a process of rearrangement and selection, which departs from the æsthetic prepossession of the major collection in favour of a grouping of interests to give as full and as educative a picture as possible of India's national culture as a whole in its historical and geographical setting. Consternation aroused by this proposal to destroy what all who have examined it with any care must agree is a brilliant essay in museum arrangement on scientific and educational lines, has to some extent been allayed by an assurance received by Sir Francis Younghusband, as president of the India Society, that the collections will not be distributed, but will remain as a part of the Victoria and Albert Museum.

Satisfactory as this may seem, it is questionable whether it goes far enough. Is it to be assumed that provision will be made for the expansion which will be necessary to carry out fully the scheme now in progress of development? Unless the present divorce of antiquity from historic times is to continue, it is difficult to see how adequate provision for a satisfactory display of Indian culture can be made short of a much enlarged museum. For not only are the antiquities of the original collections, including many valuable examples of early Buddhist art, still housed at the British Museum, although the property not of the trustees of that institution, but of the Secretary of State for India, but also the span of time to be covered now goes back to the beginning of the third millennium B.C. in the civilization of the Indus valley. Further, geographically, Indian cultural study now leaps the barrier of boundaries to extend half over Asia, from Irak to Central Asia, China, Japan, Further India and Indonesia, so far as Bali and distant Celebes. The material available in the national collections—the Aurel Stein collections from Central Asia alone are unique as documentary evidence for the spread of Buddhist art and Indian influence—if brought together under one roof, would demonstrate

Indian culture in a manner possible nowhere else among the collections of the world, even in India itself.

On the grounds of public policy, the formation of a museum of Indian life and culture cannot be too strongly urged. Now that the bonds of Empire have become tenuous indeed, we hold India by a thread. But impalpable bonds, as has been shown by the visit of the British Association delegation to the jubilee meeting of the Indian Science Congress Association this month, can be made stronger than any material force. To the degree in which our future policy towards India is rooted in an understanding of Indian aspirations on the part of the British people, the greater the strength of the bond that will hold this great country within the Empire. A great Indian cultural museum would certainly contribute the major part to such an understanding. It would show that whatever the differences between the two peoples may be, to India belongs a civilization older than our own, which in art and intellectual accomplishment has been in no way our inferior, while in Buddhism it has produced a creed which more nearly than any other in the world's history approaches the way of life inculcated by Christianity.

Principles of Biological Control

The Biological Control of an Insect in Fiji

An Account of the Coconut Leaf-mining Beetle and its Parasite Complex. By T. H. C. Taylor. Pp. 239 + 23 plates. (London: Imperial Institute of Entomology, 1937.) n.p.

WORKERS in the field of applied science are often reproached by their academic colleagues engaged in pure science with their failure to publish their methods and results and with the sketchy and inadequate character of what they do publish. This complaint is based, to some extent at least, on a misunderstanding of the object of applied science, which is not, primarily, the discovery of truth, but simply the production of facts. We call in the medical man to cure our rheumatism, and the builder to put up our house. We do not expect them to write monographs on these subjects, and we should feel rather dissatisfied if we found that they were doing this instead of getting on with the job for which we paid them. A certain continuous pressure brought to bear on the economic worker often prevents him effectively from exploiting the scientific by-products of his work; and in some cases this pressure is probably both necessary and justifiable.

On the other hand, it is clear that there are vast fields of applied science in which such effective practical rules as have been worked out in medicine and bricklaying do not yet exist, where almost every conceivable practical operation is at the same time a scientific experiment, on the result of which further progress depends. In such cases, it may be impossible to draw any lesson from the work done unless the methods used and the consequence of resultant events are recorded in detail. Furthermore, though there is not necessarily any connexion between the power of doing something well and the ability to explain how it is done, it does seem that, for the full comprehension of data, explanation carried to the point of actual exposition is highly desirable. Writing up our facts for publication helps us to realize not only what we know, but also, and even more important, what we do not know.

Work on the biological control of insect pests, which is applied entomology of the most difficult and complex description, has suffered a good deal in the past, and still suffers, from the fact that scientific analysis has not kept pace with practical experiment. Great operations have been carried out in certain parts of the world of which we can scarcely say whether they have succeeded or failed, to say nothing of specifying the reasons for failure and success. Attempts have been made in recent years to deal with some of the problems of biological control by mathematical methods; but, interesting and suggestive as they are, it is only too obvious that they can never replace the observation of actual events and indeed, the investigations carried out by workers like Salt, Lloyd, Ullyett, Walker and others on the problem of host selection have made amply clear the defects of the concepts embodied in the basic equations of our mathematical theories. Fundamental work on a large scale is urgently required and although, as was pointed out in NATURE of February 20, 1937 (p. 304), the authorities concerned with operations in biological control in the British Empire have not yet provided for it, satisfactory progress cannot be made until the need is met.

In these circumstances, we feel sure that every student of biological control will heartily welcome Dr. T. H. C. Taylor's fascinating monograph on

the successful control, by parasite introduction, of the coco-nut leaf-mining beetle in Fiji. Dr. Taylor was one of the entomologists associated with Dr. J. D. Tothill in the brilliantly successful work he carried out in Fiji on the coco-nut moth. These entomologists have consistently adhered to the practice, which we are here advocating, of exploiting the scientific aspect of their problems to the full, so that they and all the other workers in the field have not merely the satisfaction of a spectacular success, but also a reasonable explanation of how it has been obtained.

The subject of Dr. Taylor's work is the leaf-mining hispid beetle, *Promecotheca reichei* Baly., which is injurious to coco-nuts in Fiji, Samoa, Tonga and some of the intermediate islands. It is attacked in its native home by a number of natural enemies which, in normal circumstances, are able to keep the pest under control. In comparatively recent years, however, this natural equilibrium has been disturbed owing to the accidental introduction of the well-known parasitic mite *Pediculoides ventricosus*. This mite is able, under favourable conditions, to destroy a very large proportion of the hispids; but it is unable to maintain permanent control. The actual outcome of its work is to produce gaps in the sequence of host material of such a character that the original native parasites suffer severely and outbreaks of a very serious character occur. The practical problem, then, was to find in some other areas parasites capable of reproducing on *Promecotheca* and able to bring it under control in the abnormal condition created by the mite *Pediculoides*. Dr. Taylor's account of the attack on this extraordinary problem, which was eventually solved by the introduction of a chalcid parasite found on other leaf-mining hispids in Java, is of great theoretical and practical interest and contains a mass of valuable and illuminating observations on the biology and interrelations of the various species involved.

A few minor criticisms may be made. The work is adorned with a large number of beautiful and costly plates, the like of which few entomologists are able to secure for their papers in these days; but the anatomical details there represented, though perhaps sufficient for the purposes of their particular problem, are, according to our modern standards, inadequate. In some cases, Dr. Taylor's account of events, though highly interesting and plausible, rather fails to produce complete conviction, because the basic numerical data have not been exhibited in sufficient detail. At one point (p. 16), he gives a surprisingly full account of the variation in the *Promecotheca* population before the advent of the white man in the islands, which the present writer found a little staggering. The suggestion (p. 204) that the limited quantity or unusual quality of the food of parasite larvæ "causes them to become male by a process in the nature of castration" also requires amplification.

In regard to this and other matters the author shows signs of isolation from other workers due partly no doubt to the circumstances of his work and the habit engendered by it of doing everything single-handed. We think, also, that his paper could have been compressed with advantage. Nevertheless, it is, as it stands, a highly original and stimulating monograph, and a striking example of what individual effort can accomplish as against mere mass organization.

A Statistical Survey of the Stellar Universe

Lehrbuch der Stellarstatistik

Von Prof. Dr. E. v. d. Pahlen. Unter Mitwirkung von Dr. F. Gondolatsch. Pp. xvi + 934. (Leipzig: Johann Ambrosius Barth, 1937.) 96 gold marks.

THE title of this book gives a rather bald impression of its contents, and we may be permitted to amplify it into "the spatial and dynamical structure of the stellar universe, based on the observed statistics of stellar magnitudes, spectra, masses and motions". Our first word must be one of welcome for this encyclopædic volume. If we leave out of consideration the relevant portions of the "Handbuch der Astrophysik" (a work in which there is considerable, but excusably unavoidable, overlapping, due, of course, to the different predilections and points of view of the several experts concerned) the present volume is the first systematic treatment of the subject since Eddington's classic "Stellar Movements and the Structure of the Universe" was published nearly a quarter of a century ago. When we consider the immense amount of observational and theoretical investigations during the last two decades, it is indeed surprising that an attempt has not been made before this to gather into a coherent whole the researches of a multitude of workers in this important field.

Dr. v. d. Pahlen's general mode of treatment is the historical, and the principal contributions to the several sections are described in roughly chronological order. There is a lot to be said for

this procedure, but, on the other hand, the magnitude of the book tends to become of almost astronomical dimensions, and this may well prove a real defect so far as its circulation in astronomical circles is concerned. Again, the author's thoroughness in dealing with his subject is commendable, but, to a large extent, it is unnecessary, especially in the earlier stages; it is scarcely likely that the reader of the book will be wholly unacquainted with the elementary principles of astronomy, such as the measurement of right ascension and the classification of spectra—to take only two examples. Our view is that the book is, in the first instance, a specialist's book and, in the second, a work of reference; accordingly, we feel that its value would have been greatly enhanced by a judicious—and, in some places, a severe—pruning of elementary and other topics that are dealt with in more general publications.

It is scarcely possible to give, within the compass of this review, more than a rough sketch of the contents. The first part—amounting to a little less than one sixth of the whole volume—is concerned with the mathematical development of statistical theory and, in particular, with the discussion of normal and skew frequency functions and the theory of correlation. This section had been written by Dr. Hufnagel, whose death, five years ago, deprived Dr. v. d. Pahlen of an experienced collaborator almost at the outset of the project the fruition of which is seen in the present volume. It may be interpolated here that three chapters in later parts of the book—amounting to about 130 pages in all—are from the pen of Dr. F. Gondolatsch of the Recheninstitut, Berlin-Dahlem. The mathematical methods developed in the section under consideration bear the impress of the influence of the Lund school and, in particular, of the late Prof. Charlier; the section is a clear and comprehensive exposition of the subject as formulated. It is to be remarked, however, that the plan of systematic comprehensiveness has partially broken down here, as the theory of combining observations according to well-known methods—such as we find in the solar motion problem, to take a simple instance—is omitted.

The second part of the volume, amounting to two hundred pages, deals with the observational side of the subject, namely, the determination of such stellar characteristics as position, proper motion, radial velocity, brightness, colour, spectrum and parallax. This is one of the sections where the reviewer's earlier criticism applies in considerable measure. However, apart from this, the author has done his work exceedingly well, and the reader will find all the information about past and modern observational practices that he is likely to require. In the latter pages of this section the usual methods of deriving statistical parallaxes are developed in full; the work of Kapteyn and van Rhijn in this interesting field is described at length and correlated with the theoretical formulæ derived about a quarter of a century ago by Schwarzschild. An omission of theoretical and of some practical importance concerns the effect of the well-known systematic motions of the stars on the mean parallaxes derived according to the methods described.

The third, and the longest, section of the work is concerned with the space distribution of the stars. Numerous investigations on this subject depend on an initial assumption as to the mathematical form of the stellar density function, with or without a further assumption as to the law governing the distribution of the absolute magnitudes of the stars investigated. This mode of procedure is dictated by the fact that our knowledge of stellar distances, as determined by direct or ancillary methods, stops short at a comparatively trifling distance from the sun. On the other hand, the apparent magnitudes of the stars can be determined easily and accurately. In general, apparent magnitude is not a completely satisfactory criterion of distance, but, with the stars segregated according to colour-index, statistical investigations based on counts of stars of different apparent magnitudes are of undoubted value in giving us reasonably trustworthy information as to the structure of the stellar system. A second line of attack is based on the observed proper motions of the stars; it may be remarked that proper motion is a much better criterion of distance than apparent magnitude. The author gives also a full account of the methods based on Schwarzschild's integral equations. Within the last ten years, a serious complication to the statistical methods has been introduced by the discovery of well-marked galactic absorption—in this connexion Trumpler's investigation of open clusters may be mentioned as placing beyond doubt the existence of a comparatively thin absorbing layer in the equatorial plane of the galaxy. The author describes fully and successfully most of the fundamental investigations carried out within recent years, with commendable emphasis on the present situation as created by the discovery of galactic absorption.

The fourth and final part of the volume deals with the kinematics and dynamics of the stellar system. It may be noted in passing that there is a certain amount of unnecessary reiteration in connexion with the solar motion. Kapteyn's two-streams theory and Schwarzschild's ellipsoidal hypothesis concerning the systematic motions of the stars are treated fully. Schwarzschild's original papers are not readily accessible and the detailed

account of his methods as presented by Dr. v. d. Pahlen will be welcomed. Of the two mathematical formulations of the systematic motions of the stars, Schwarzschild's is the more convenient, from the analytical point of view, in theoretical investigations in stellar dynamics, a subject which has received an increasing amount of attention during the last decade, on both the observational and the mathematical sides. The author gives a good, though not quite complete, account of the researches in this field. The theories of galactic rotation associated with the names of Oort and Lindblad are described at length, and the observational material patiently gathered in recent years has been summarized in tabular form.

Dr. v. d. Pahlen is to be heartily congratulated on completing this authoritative volume, which will prove indispensable to present and future workers in the field surveyed.

W. M. S.

Asiatic Yams

An Account of the Genus Dioscorea in the East Part 1 : The Species which Twine to the Left. By D. Prain and I. H. Burkill. (*Annals of the Royal Botanic Garden, Calcutta*, **14**, Part 1.) Pp. 210 + vi. 91 Plates. (Alipore: Bengal Government Press, 1936.) 75 Rs.; £5 13*s*.

THE yam, the tuber of various species of *Dioscorea*, is a staple food in the tropics and commonly cultivated, especially in India, Malaya and tropical Africa. The two volumes under notice, which maintain the excellence of production of the *Annals of the Royal Botanical Garden, Calcutta*, form the first part of an account of the Oriental species by two eminent botanists who, by thirty years of careful investigation, have specially qualified for the task.

The genus is a large one and has been the subject of monographs by previous botanists, who, however, have had at their disposal mainly herbarium material. The origin of the present monograph dates from the difficulties experienced by the late Sir Joseph Hooker when revising the genus for the "Flora of British India", and by the late Sir George Watt in his efforts to elucidate the cultivated species for his "Dictionary of the Economic Products of India". Hooker, in 1892, found the species in a state of indescribable confusion, and the food-yielding species for the most part indeterminable. He begged Watt and Sir George King, then in charge of the Calcutta Garden, to grow, not only all the food-yielding forms, but also as many of the uncultivated species as could be procured. In 1898, on King's retirement, the collaboration devolved on Sir David Prain, his successor, and in 1901 Mr. Burkill took over from Watt. When the senior author left India in 1904, Mr. Burkill continued the systematic study of the living material in cultivation in the Garden, and when transferred to Singapore in 1912 extended his study to species outside the limits of India. Since his return to England in 1925, he has continued his work at Kew. Material has also been examined in or from all the important herbaria at home and abroad.

Part 1 includes the species that climb to the left, comprising nine of the ten sections into which the authors divide the genus. Part 2 includes the species that climb to the right, that is the large section *Enantiophyllum*, and also a tabulated account of the distribution of the species, a phytogeographical review and the history of the various collections that have been studied. Text and plates are already in print and these should appear shortly.

The authors, for sake of completeness, have included the very rare Pyrenean species *D. pyrenaica*, the sole representative of the anomalous section *Borderea*, a dwarf, non-climbing plant which in some characters recalls the temperate Old World genus *Tamus*—the black bryony of our hedges; also two species respectively from the Balkans and the Caucasus that are allied to oriental species.

The ten sections under which the species are grouped represent an arrangement differing from those of previous monographers, which are critically examined by the authors. Thirty years' experience of cultivating the oriental species indicates that the subgenera recognized by E. B. Uline in the "Pflanzenfamilien" (1897) and by R. Knuth in the "Pflanzenreich" (1924) should be discarded.

The general description includes a study of the formation of the food-storage organ—tuber, rhizome or corm—by which the plant persists from season to season and which supplies prime characters for the construction of groups of sections. Opinions have differed as to the morphology of the tuber, which has been regarded as a root structure, or by Goebel as an organ *sui generis* combining the characters of root and shoot. The authors, however, are convinced that it is a stem structure.

The form of the leaf shows great variety on a simple cordate type, but in two sections palmately compound leaves occur. The male flowers, capsule and seed also afford distinctive characters.

Seventy-six species are recognized, and the thoroughness of the work is indicated by the very large proportion that have been described by the authors in the course of their studies. Synonymy is given in full and expresses the confusion to which Hooker referred, dating back sometimes to Linnæus himself. The species are very unequally distributed among the sections; elaborate keys are supplied for their identification. Each species is described at length and each description is admirably supplemented by a plate which, whenever possible, includes details of form of the storage organ, together with figures of leaf, flower and fruit. Dialect names are discussed, and economic uses, mainly as food, for which often careful preparation is required that poisons may be removed which have also economic uses. Geographical distribution is given in very great detail, and every specimen examined is cited.

The production of the plates, which suggests a crayon drawing, is pleasing. Some are by native artists, others by the late Matilda Smith of Kew and others by Mr. Burkill himself. There are also five plates of maps indicating the geographical regions recognized and the distribution of the individual species. The financial aid of the Bentham-Moxon fund towards the production of the plates is acknowledged.

Theory of Fourier Integrals

Introduction to the Theory of Fourier Integrals By Prof. E. C. Titchmarsh. Pp. x + 390. (Oxford: Clarendon Press; London: Oxford University Press, 1937.) 17*s.* 6*d.* net.

SINCE the publication of Prof. Zygmund's "Trigonometric Series" in 1935, there has been considerable demand for another book dealing with trigonometric integrals. Prof. Titchmarsh's book meets this demand. He is already well known to students of mathematics by his text-book on the theory of functions, and his new book comes up to the high standard of the former.

After two more or less introductory chapters, Prof. Titchmarsh devotes a chapter to the theory of Fourier transforms in the class L^2, that is, the class of all functions whose squares are integrable in the Lebesgue sense. This is undoubtedly the most important part of the subject. The theory centres round a very beautiful theorem due to Plancherel, which asserts that every function (x) of Lf^2 has a Fourier transform $g(x)$ also in the class L^2 and

$$\int_{-\infty}^{\infty} \{g(x)\}^2\,dx = \int_{-\infty}^{\infty} \{f(x)\}^2\,dx.$$

Plancherel's original proof was published in 1910, and since then other proofs have been given by various writers. Prof. Titchmarsh gives four of these proofs, including Nobert Wiener's very interesting proof, of which the chief feature is the use made of the Hermite polynomials.

The Lebesgue theory of integration is fundamental in all this work, and in reading this chapter no one can fail to be impressed by the tremendous amount which the theory of Fourier integrals and mathematics generally owes to Lebesgue's definition of the integral.

The chapter on Fourier transforms in L^2 is followed by another on transforms in L^p. The symmetry which exists in L^2 is of course lost in other Lebesgue classes. There are, however, analogues for most theorems. Among the other topics treated may be mentioned the general theory of transforms and the theory of conjugate functions. The last two chapters are devoted to applications to the solution of differential equations and integral equations respectively. In the latter chapter, examples are given of the use of Fourier transform methods in the theory of probability and statistical dynamics. The book concludes with a long bibliography.

Prof. Titchmarsh is to be very warmly congratulated on his book. As the title implies, it is primarily an introduction to the subject and does not cover the whole field. The author has not attempted to give an account of all the recent developments, especially the more specialized ones. Those who wish to pursue the subject further can refer to Wiener's "Fourier Integral", Boehner's "Vorlesungen über Fouriersche integrale" and, above all, Paley and Wiener's, "The Fourier Integral in the Complex Domain". Fourier integrals have much in common with Fourier series, and this subject has been very adequately treated in Zygmund's book, to which reference has already been made.

The book under notice is probably of more interest to analysts than to applied mathematicians, but the latter might find much that interests them. No one should be put off by the Lebesgue theory of integration, as it is only necessary to know a few of the properties of the integral, especially those concerning strong convergence. The book contains a sufficient number of examples, including applications to mathematical physics, to illustrate the scope of the methods. A. C. OFFORD.

Raum oder Zahl?

Von Cl. H. Tietjen. (Schule im Aufbau aus völkischer Wirklichkeit, herausgegeben von Cl. H. Tietjen, Band 6.) Pp. 51 + 4 plates. (Leipzig: Friedrich Brandstetter, 1936.) 1.59 gold marks.

SPACE or number? Is the infant intelligence to be inclined towards mathematics by curiosity about shapes and patterns, or do we perceive that there are as many oranges as apples before we recognize a common quality of roundness? Artificial questions, we may think, but at least we take for granted that they are questions for the psychologist. It seems that we are wrong. According to a work which claims the support of the German Ministry of Education, they are questions of immense importance, and questions for the ethnologist and the politician. Fortunately the answers in Germany at least are perfectly definite, for the alternative, space or number, is the same as the alternative, German or Jew.

The Nordic race has a native feeling for space, which it is the duty of every teacher to foster, and German children, from their earliest years, must be protected from the logic which curses the mathematics of the Latin and Semitic peoples. Even the application of numbers to geometry is a danger, for we cannot report the direction of approach of hostile aircraft in terms of Cartesian co-ordinates, and the only hope of safety for a nation to-day is that every member of it should be a competent military observer. It is true that even altazimuth observations are a kind of measurement; fortunately their use is not a development from analytical geometry or a debt to Asia, for it is implicit in the most rudimentary astronomy, and it is intuitively certain that the regular movements of the heavenly bodies were studied and understood by the German inhabitants of the north of Europe long before the rise of Chaldæan civilization. So now we know. E. H. N.

Faune de France

31: Homoptères auchénorhynques, 1 (Typhlocybidæ). Par Prof. H. Ribaut. (Fédération française des Sociétés de Sciences naturelles: Office centrale de Faunistique.) Pp. 230. (Paris: Paul Lechevalier et fils, 1936.) 60 francs.

THE advent of the present part of the "Faune de France" series will be welcomed by all students of Hemiptera. It deals with leaf-hoppers of the group Typhlocybidæ, which are often difficult to identify, and much confusion has existed with regard to certain of its members. Although more usually classified as a group of the Jassidæ, M. Ribaut separates the Typhlocybidæ from the latter on venational characters. Revision of the British species has long been needed and the appearance of this volume will prove a valuable aid to their identification since almost all of them are represented in the French fauna. Twelve new species and several new varieties are described, some also being recorded from England, and are consequently not yet recorded in any English work.

It may be mentioned that certain species (from England, Germany, etc.), which are not at present known from France, are also included in view of the probability of their subsequent discovery. Extensive use is made of the genitalia, which afford essential specific characters. The need for accurate illustrations of these parts is fully appreciated and well catered for; no amount of descriptive text alone can convey the same clear impressions of the structural complexity involved. It is hoped that M. Ribaut will see his way to provide the companion volume on the Jessidæ at a not very distant date.

The Torch-Bearers

By Alfred Noyes. Pp. vii + 422. (London: Sheed and Ward, 1937.) 7*s.* 6*d.* net.

THE man of science, though he must be full of imagination and insight as the veriest poet, has rarely become known as a writer of verse; and strangely enough, when he has shown a flair for poetry, it has not generally been inspired by the subject of his own studies. The poet, so far as he has touched upon natural science, has been content to let his muse play upon the phenomena of Nature, the sun, the stars, the clouds, the trees, the woodlands and their inhabitants. To Mr. Alfred Noyes belongs the credit of seeing in the wonders of scientific achievement a theme which can stir the soul with deep emotion, and in the workers who have dedicated themselves to the pursuit of science a band of torch-bearers, handing on the flame of knowledge through the ages. His trilogy appeared originally in three parts, which were reviewed appreciatively in these columns as they appeared (NATURE, May 20, 1922, July 18, 1925, and March 7, 1931). The issue of the three parts in a single volume, at a very modest price, will be much appreciated.

Aristotle's Physics

A revised Text, with Introduction and Commentary, by W. D. Ross. Pp. xii + 750. (Oxford: Clarendon Press; London: Oxford University Press, 1936.) 36*s.* net.

THIS scholarly work has been received by students and specialists alike as an invaluable addition to Aristotelian literature. The Introduction and Commentary are masterpieces of their kind and help considerably the understanding of a natural philosophy which does not correspond with modern views, but which inspired scientific thought until the advent of Galilean mechanics. The physics of Aristotle, however, have more than a historical value: they help to form a more accurate view of the whole Aristotelian synthesis, and of the scientific problems which were discussed in classical antiquity. Further, its philosophical foundations could still be used to-day; have we not heard scientific workers heralding a return to Aristotelianism in natural philosophy? The printers have taken considerable care in producing a Greek text as faultless as possible, and have thus secured a share in the praise which the book rightly deserves. T. G.

The Scientific Activities of Sir Charles Parsons

THE second Parsons Memorial Lecture was delivered on November 25 last by Dr. Gerald Stoney at the Institution of Electrical Engineers. As Sir Frank Smith in the first of these lectures, given at Newcastle-upon-Tyne a year earlier, had dealt at length with the invention and application of the steam turbine, Dr. Stoney devoted his lecture to the less well-known activities of the great engineer. This was a subject for which he was pre-eminently fitted, for he was closely associated with Sir Charles Parsons during his most prolific period. Parsons himself once spoke of Dr. Stoney as having grown up with the Heaton Works of Messrs. C. A. Parsons and Co., but he was also closely connected with the work of the Parsons Marine Steam Turbine Co. Much of what he had to say was therefore of great historical interest.

The question may well be asked what led Parsons to the conception of the steam turbine. At the outset, Dr. Stoney answered this by recalling that, when quite a young man, Parsons was interested in the production of power from the kinetic energy of a jet of gas. His first efforts in this direction were applied to the development of torpedoes, which were driven by the kinetic energy of gases produced by the combustion of an explosive. His ideas were also largely influenced by noticing the analogy between the flow of steam under small differences of pressure and the flow of an incompressible fluid like water. At Heaton is preserved a model boat (Fig. 1) the propeller of which was driven by the action of compressed air. The screw propeller is fitted beneath the centre of the boat and is surrounded by a double shrouding carrying blades on which the jet of air impinged. It is evident, said Dr. Stoney, that this work led to the conception of the steam turbine.

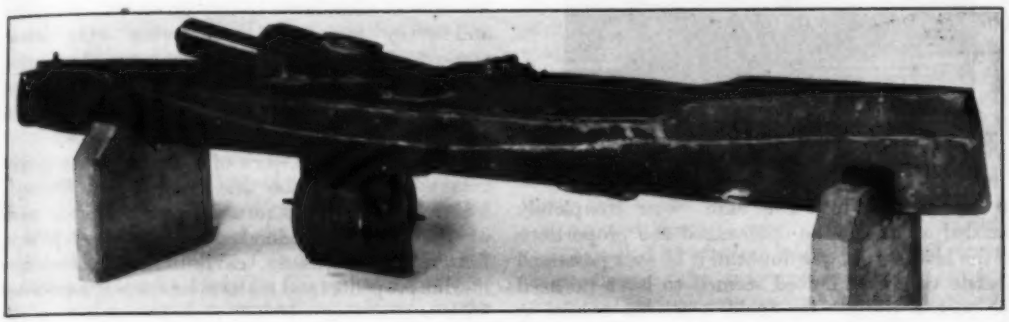


Fig. 1.

MODEL BOAT, DESIGNED BY SIR CHARLES PARSONS, DRIVEN BY COMPRESSED AIR.

Fig. 2.

ARMATURE OF THE FIRST PARSONS TURBO-GENERATOR.

Though he was influenced by analogies between the flow of steam and the flow of water, Parsons never told anyone, not even the most trusted members of his staff, how he arrived at the design of an actual machine for any given conditions. Possessing high mathematical ability, he was rarely, if ever, known to make use of formal mathematical reasoning for the solution of any problem. He had a thoroughly scientific mind and scientific habits of thought, and his results were the outcome of these, rather than of any deliberate calculations. In the early days, he would come into the office with a scrap of paper on which were written particulars of the blading he had decided upon for a certain turbine. These were set out to scale and modified if necessary according

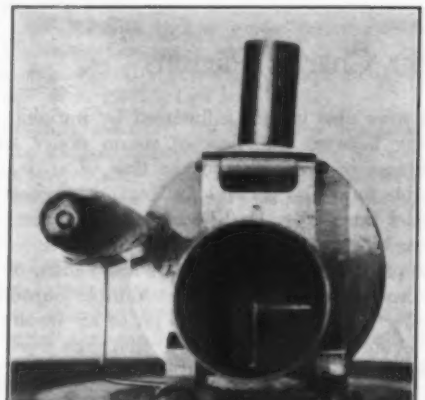


Fig. 3.
THE AUXETOPHONE MOUNTED ON A GRAMOPHONE RECORD.

to his judgment. The staff was completely puzzled as to how he determined the proportions of the blading. It was doubtful if he ever possessed a slide rule, and indeed seemed to have no need for such a thing. He could work out results in his head or on paper as quickly as most people could obtain them on a slide rule, though he never explained the process and it is doubtful if he could have done so.

It never seemed to Parsons that his powers were exceptional. He had an extraordinary intuition on all matters connected with design. No matter how difficult or novel the problem, he seemed to know instinctively how to solve it. He also had great mechanical aptitude. He was perfectly familiar with all workshop processes, and had unusual skill with his hands. He took a delight in making models, not as ends in themselves, but as a means of studying some problem.

It was in 1884 that Parsons made his first turbo-generator. This developed about 4½ kw. at 18,000 revolutions per minute. The dynamo had to be specially designed, for dynamos at that time revolved at about 1,200 revolutions per minute. The armature of this first turbo-generator (see Fig. 2) was only about 2⅜ in. in diameter. Every pound weight at the surface of it had a centrifugal force of about 5 tons at the normal speed of the machine, so great care had to be taken to make the construction sufficiently strong to resist mechanical stresses. Few better examples of Parsons's intuition, said Dr. Stoney, can be given than the fact that the proportions of his first turbo-dynamo, designed fifty-three years ago, when electrical knowledge was so rudimentary, could scarcely be improved upon to-day. After further references to the development of turbo-dynamos and turbo-alternators, Dr. Stoney remarked: "Some of the practices of these early days must now appear very primitive, but one must remember that Parsons was breaking new ground in almost every direction. Books such as we have in abundance to-day on steam, electricity and every branch of engineering were either non-existent or extremely elementary. Measuring instruments, as we know them to-day, did not exist and the range of materials for constructional and insulating purposes was very restricted."

The record of the work of Parsons on the turbo-generator formed the first half of Dr. Stoney's lecture, and he then turned to consider the work of Parsons on condensing plant, turbo pumps, fans and compressors, cavitation, the erosion of marine propellers and matters less closely associated with engineering. It will perhaps come as a surprise to many to learn that when Parsons was deeply immersed in his early study of the turbine and the dynamo, he should have turned to the manufacture of electric lamps. In 1885, when a partner in the firm Clarke, Chapman, Parsons and Co., he founded the Sunbeam Lamp Company, making arc lamps and incandescent lamps. At

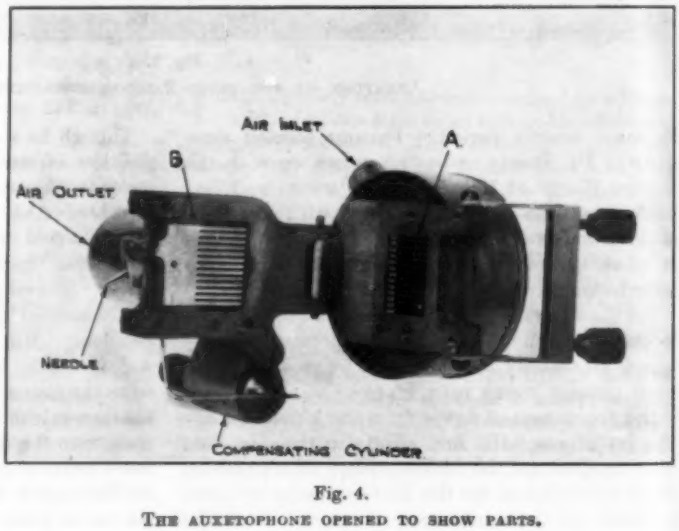


Fig. 4.
THE AUXETOPHONE OPENED TO SHOW PARTS.

first small lamps were made, but after a legal decision in a patent action that a 'filament' was less than $\frac{1}{32}$ in. in diameter, the Company restricted itself to the production of lamps having 'carbons', not 'filaments', of $\frac{1}{32}$ to $\frac{1}{4}$ in. diameter. The lamps ranged from 100 to 3000 c.p. At the Newcastle Exhibition of 1887, lamps made by the Sunbeam Co. were used for lighting, the current being supplied by ten Parsons turbo-dynamos ranging from 16 kw. to 32 kw. in capacity. Little information has been preserved as to the processes used in the manufacture of the lamps, but the material for the carbons appears to have consisted of tar, a special anthracite and zirconium.

To the same early period—the 'eighties—belongs the early optical work of Parsons, which began with the manufacture of parabolic mirrors for searchlights. He devised a process for bending the glass while hot in an accurately figured cast-iron mould, and his methods are used to-day with very little alteration. Several hundred mirrors per month are now turned out at Heaton for searchlights and other purposes. He had always a liking for optical work, no doubt inherited from his father, the Earl of Rosse, whose 6 ft. telescope at Birr was the wonder of the astronomical world. After the Great War, Parsons purchased the optical glass works set up by the Government near Derby and acquired a controlling interest in the firm of Messrs. Ross, Ltd. A year or two later he acquired the works of Sir Howard Grubb at St. Albans, and forming the firm of Sir Howard Grubb, Parsons and Co., Ltd., founded new works at Walker Gate, close to the Heaton Works, and it was there the 74-in. telescope for Toronto, the largest in the British Empire, was built.

Parsons's interest in other scientific matters was shown by his suggestion for a very deep bore hole, his experiments on the artificial production of diamonds, his experiments on the compressibility of liquids and his invention of the auxetophone. About 1902, when phonographs and gramophones were becoming popular, he realized that their reproduction of sound was far from satisfactory. He therefore decided to make a reproducer worked by compressed air by which the sound waves should be generated more in accordance with the action of an organ pipe than that of a telephone receiver. Then followed experiments on the flow of air and trials with various types of valves which could be controlled by the needle of the gramophone. Figs. 3 and 4 show the auxetophone mounted above a gramophone record, and open to show the valve and its seating. The moving part of the valve, about $\frac{1}{2}$ in. by $\frac{3}{4}$ in., was a flat comb of magnalium. Air at about 2 lb. per square inch was supplied to the wind-box through a flexible tube. Such a valve, said Dr. Stoney, made thirty-five years ago, reproduced sound with a volume and quality which have only recently been equalled by wireless loudspeakers and electric gramophones. The auxetophone was also applied to musical instruments, and was used with success in the orchestra at the Queen's Hall, London, in 1906. The invention of this instrument was entirely the work of Parsons's leisure hours, just at the time he was engaged in the application of steam turbines to naval vessels and fast mercantile ships.

Heat Production, Nutrition, and Growth in Man: Some New Views*

By Dr. E. P. Poulton

Constancy of Carbon Dioxide

Series of basal metabolism observations on the same individual have been published by a number of observers, and analysis shows that when the previous diet did not contain much carbohydrate the carbon dioxide tended to remain more constant than did the oxygen, which fell as the quotient rose. When the previous diet was rich in carbohydrate there was a tendency for the carbon dioxide to rise. It will be shown that a constant carbon dioxide as shown in Figs. 1 *a* and 1 *b* is in favour of the theory of the constant combustion ratio, and, such being the case, further observations would be desirable to prove definitely the relation of this constancy to the diet taken. According to this theory, the carbohydrate and fat are always burnt in a fixed ratio corresponding to a quotient of about 0·8, and if the quotient is higher there is a simultaneous conversion of carbohydrate to fat and if lower a conversion in the opposite direction. Such a theory cannot be proved by metabolic determinations on the whole organism between the respiratory quotients for the combustion of pure fat and pure carbohydrate, because it would make no difference whether with a higher quotient a higher proportion of carbohydrate was burnt or whether the same amount was burnt as before and the extra amount disappeared by being

*Continued from p. 147.

turned into fat. But biochemically in the organism there might be a big difference between the two theories, because combustion of carbohydrate and fat in a fixed ratio might be occurring in one place, while a simultaneous conversion might be occurring elsewhere in the organism. Cathcart and Markowitz have also pointed out that it would be absurd to suppose that conversion suddenly began just as the quotient rose above 1, and that it probably does begin at a much lower quotient.

A detailed study of all DuBois's results, which it is hoped will be published in the *Guy's Hospital Reports*, shows that all the variations in respiratory quotient and measured heat are compatible with the theory of the constant combustion ratio and that those between the respiratory quotients for the combustion of fat and carbohydrate are compatible with both theories. There are any number of ways in which the carbon dioxide, oxygen and heat can change so as to comply with the variable combustion ratio; but there is only one simple way that satisfies the theory of the constant combustion ratio, and that is when the carbon dioxide remains constant as the quotient varies.

For example, in Table 1 are given the amounts of carbon dioxide, oxygen and heat produced by the combustion of (1) carbohydrate, (2) fat at varying quotients on theory 1, according as (*A*) the carbon dioxide remains constant, (*B*) the oxygen remains constant, (*C*) the heat remains constant. The values are calculated from a Zuntz-Schumburg table deduced from the figures given (p. 70) in the *Guy's Hospital Reports* (**85**, 56; 1935); but the argument is unaffected by the particular Zuntz-Schumburg relation used. Any number of other tables could be calculated with variation of both oxygen and carbon dioxide with the quotient. The point is that all the tables resemble one another in the increased amount of carbohydrate and diminished amount of fat burnt with rise of quotient, and if the experimental results agreed with any of the tables the theory of the variable combustion ratio would be applicable; there is no reason on theoretical grounds for choosing *A*, *B*, *C*, or any other combination.

When, however, in Table 2 the results are expressed on the theory of the constant combustion ratio, in *A* where the carbon dioxide is constant (it is assumed that at a respiratory quotient of 0·8 combustion in a fixed ratio is alone taking place), the simplest state of affairs is obtained; this is because on this theory carbon dioxide can only result from combustion (*loc. cit.*, p. 68) and oxygen plays a part both in combustion and in conversion. In *B* and *C* and in all other calculations we have to assume that at other respiratory quotients than 0·8 not only is conversion occurring, but there is a variation in the amount of combustion too. In all cases about 4 calories are given out or absorbed in the conversion process per litre of oxygen involved, which is equivalent to 2·1 calories per gram fat as previously calculated (*loc. cit.*). Of course, it is not necessary to take 0·8

TABLE 1.
THEORY 1. VARIABLE CONSTANT RATIO.

		R.Q.	0·72	0·8	0·9	1·0
A. Constant CO_2	CO_2 from oxidation	Carboh.	0	4·31	5·72	7·63
	" " "	Fat	7·63	3·32	1·91	0
	O_2 " "	Carboh.	0	5·38	6·35	7·63
	" " "	Fat	10·6	4·16	2·125	0
	Cals. " "	Carboh.	0	26·35	31·9	39
	" " "	Fat	5·1	20·35	10·6	0
B. Constant O_2	CO_2 from oxidation	Carboh.	0	4·78	7·15	10·6
	" " "	Fat	7·63	3·70	2·39	0
	O_2 " "	Carboh.	0	6	8	10·6
	" " "	Fat	10·6	4·6	2·6	0
	Cals. " "	Carboh.	0	29·3	39·8	54·25
	" " "	Fat	51	22·7	13·2	0
C. Constant Cals.	CO_2 from oxidation	Carboh.	0	4·7	6·83	9·96
	" " "	Fat	7·63	3·63	2·29	0
	O_2 " "	Carboh.	0	5·86	7·63	9·96
	" " "	Fat	10·6	4·54	2·54	0
	Cals. " "	Carboh.	0	28·8	38·2	51
	" " "	Fat	51	22·2	12·8	0

TABLE 2.
THEORY 2. CONSTANT COMBUSTION RATIO.

	R.Q.	0·72	0·8	0·9	1·0
A. Constant CO_2	CO_2 from combustion	7·63	7·63	7·63	7·63
	O_2 for combustion	9·54	9·54	9·54	9·54
	" " conversion	1·06	0	1·065	1·91
	Cals. from combustion	46·7	46·7	46·7	46·7
	" " conversion*	4·3	0	4·2	7·7
B. Constant O_2	CO_2 from combustion	7·63	8·475	9·54	10·6
	O_2 for combustion	9·55	10·6	11·95	13·25
	" " conversion	1·05	0	1·35	2·65
	Cals. from combustion	46·8	52	58·5	65
	" " conversion*	4·2	0	5·5	10·75
C. Constant Cals.	CO_2 from combustion	7·63	8·33	9·17	9·96
	O_2 for combustion	9·53	10·4	11·45	12·44
	" " conversion*	1·07	0	1·28	2·48
	Cals. from combustion	46·75	51	56·1	61
	" " conversion*	4·25	0	5·1	10

* The Cals. per l. oxygen used in conversion are obtained by dividing these figures by those two lines above.

as the respiratory quotient for pure combustion; this method of calculation would be valid for any other respiratory quotient.

It was pointed out above that Benedict's results could not be explained on the theory of the variable combustion ratio. But on applying the theory of the constant combustion to them there is this difficulty, namely, that more heat is liberated at high quotients than would be accounted for by the combustion of the constant carbohydrate-fat mixture and a simultaneous conversion of carbohydrate to a less oxygenated compound; this would mean that removing oxygen from the molecule of an organic compound caused an evolution of heat, that is, diminished its heat of combustion, a condition unknown in thermochemistry. It is only right to point out that Benedict and Carpenter themselves do not now place reliance on these early results of theirs, because the oxygen determinations were not very accurate. Dr. Carpenter has kindly sent me the figures for the eliminated heat in Figs. 1 *a* and 1 *b*, and it does not seem possible to account for the discrepancy by a wide difference between the direct calorimetry and the eliminated heat. I must accept their explanation, though I have already pointed out that the oxygen values in the alcohol control experiments were satisfactory, and it will be necessary to assume a large error in the oxygen.

Summarizing—on the theory of the variable combustion ratio, a carbon dioxide that rises, falls or is stationary with rise of quotient is equally probable; and this theory is not applicable to the higher quotients; on the theory of the constant combustion ratio a constant CO_2 would be expected and this is, in fact, usually found. Further, this theory is applicable to all quotients. Hence, if the facts are looked at *de novo*, paying no attention to the views held from the beginning of the century up to the present day, this theory would probably be chosen.

It must be admitted that this theory is not altogether unreasonable. Many quantities associated with the human body have in health a more or less constant value. The body temperature at rest varies within comparatively small limits, and the same is the case with the hydrogen ion concentration of the blood and the quantity of phosphocreatine broken down in relation to muscular work; while the amount of sleep remains the same for an individual at any particular age. Why should not carbohydrate and fat be burnt in constant proportion in the post-absorptive condition in a normal healthy man. The story of Cain and Abel suggests that the diet of primitive man was variable in its carbohydrate and fat content, depending on his success in cultivation, when it would be mainly carbohydrate, or hunting, when it would be mainly protein and fat. Which is most likely, that the complicated metabolic processes resulting in the actions of the heart, muscles and glands should be entirely at the mercy of the individual's caprice (or luck) in his choice of food, or that these processes should in the main run always along well-defined lines of chemical and physical action, while any foodstuff taken in unusual quantities is stored in some suitable form for future use, even though this means a conversion of some kind? Is it not reasonable to look on these conversions of food as some of the earliest adaptations that the organism has acquired in the course of evolution, and, as Dr. H. E. Magee has suggested, this would be a reason for the evolution in the body of the power to manufacture the ferment glutathione, which is otherwise without a clear explanation.

A New Definition of Basal Metabolism

On the theory of indirect calorimetry, based on the constant combustion ratio of carbohydrate and fat, the non-protein carbon dioxide results entirely from the combustion of carbohydrate and fat, while the oxygen is used partly for combustion and partly in conversion processes. If the respiratory quotient is high, say, 0·9, the heat, calculated on the assumption that the oxygen is used entirely for combustion, is about 8 per cent above the heat actually found, because the heat due to combustion is diminished by the heat absorbed in the conversion of carbohydrate towards fat. Since under basal conditions there are continual small variations in the quotient, there will be continual additions to or subtractions from the heat of combustion, according as the conversion of fat to carbohydrate is taking place or vice versa. Since these conversions are ephemeral and will cancel each other over a long period, they can scarcely be regarded as part of a 'standard' metabolism, and so it is much better to neglect them, and this is done by taking the carbon dioxide alone into consideration. In these circumstances the basal or standard metabolism must be defined afresh as the heat of combustion at rest in the post-absorptive state and not as the total heat measured in a calorimeter, the value of which may be a little different, depending on the respiratory quotient. If this definition be accepted it follows that the carbon dioxide alone must be measured and no account must be taken of the intake of oxygen.

Suppose, on the other hand, we retain the older but less likely theory of the variable combustion ratio, the significance of the constant carbon dioxide still remains and we should look on the variable oxygen as indicating an ephemeral increase or diminution in the proportion of carbohydrate

to fat burnt, which is also not part of a standard metabolism. In either case, carbon dioxide should alone be used for the determinations, and the subject should probably take a low carbohydrate diet for 18 if not 24 hours before the experiment is carried out.

Practically, in determinations of the basal metabolism I find that the carbon dioxide does remain very constant over half an hour; the error from "aus-pumping" of carbon dioxide has been exaggerated.

Obituary Notices

Prof. G. A. Buckmaster

ON December 22, Prof. George Alfred Buckmaster died at the age of seventy-eight years. Buckmaster was one of the last of the great teachers of physiology of the late Victorian and Edwardian times, who in their teaching regarded physiology as the handmaiden of medicine. He was educated at Magdalen College, Oxford, where he held a demyship; he took a first class in the Natural Science Schools in 1881, and in the following year was elected to the Burdett-Coutts University scholarship in geology. He received his medical education at St. George's Hospital, qualifying in 1883, took his Oxford M.B. in 1885, and his M.D. in 1887. He also held the Radcliffe travelling fellowship and continued his studies in various German universities.

Buckmaster's first teaching appointment was that of lecturer in physiology at St. George's Hospital Medical School, which he held until 1905; he then became assistant professor of physiology at University College, London, and in addition, in 1909, accepted the professorship at the Royal Veterinary College. In 1919 he succeeded Prof. Stanley Kent as H.O. Wills professor in the University of Bristol, and he held this chair until his retirement in 1930. In 1934 he was elected F.R.C.S. (Eng.), *honoris causa*, a distinction of which he was very proud.

Buckmaster's first paper, "Uber eine neue Beziehung zwischen Zuckung und Tetanus" was published in the *Arch. f. Anat. u. Physiol.*, and was followed by a note in the *Proceedings of the Physiological Society* on a new relation between "Contraction and Tetanus". Buckmaster was selected as one of the three English members of the Leprosy Commission in India, 1890 and 1891; the results of this work are embodied in papers in the *Leprosy Investigation Journal* and in the report of the Commission; a good deal of useful information was collected, but nothing very definite was found with regard to the causation and treatment of the disease; they produced a culture, but I gather that this has not been accepted.

During his time at St. George's Medical School, Buckmaster had abundant opportunities of investigating not only normal but also pathological bloods. The results of such experiences were embodied in a series of lectures, given in the Physiological Laboratory (South Kensington) of the University of London and afterwards published in 1906 in book form under the title "The Morphology of Normal and Pathological Blood". In one chapter he gives an account of observations carried out by himself and two colleagues, Dr. Chas. Slater and Mr. C. T. Dent, during two successive years in the Alps (Mont Blanc) on polycythæmia at high levels. In another he gives a masterly discussion of the question of the existence of blood platelets in unchanged blood, and to the end of his career Buckmaster held strongly to the view that blood platelets were artefacts.

In the year 1906, Buckmaster and J. A. Gardner collaborated in the study of the mechanism of chloroform anæsthesia, and their experimental results and conclusions are detailed in a series of papers in the *Proceedings of the Royal Society* between 1906 and 1911, dealing with methods of estimation of chloroform, with the function of the red cells in carrying the chloroform around the circulation, the rate of absorption of chloroform by the blood and its rate of elimination. In general, it was found that in the initial stages of anæsthesia the chloroform content of the blood rises rapidly to a value approaching a maximum; during this period, which occupies the first few minutes, the first danger period is reached, because the quantity of chloroform in the blood directly or indirectly affects the respiratory nerve centres, and in consequence the respirations become slower and shallower; the concentration of chloroform in the blood then falls, and the respiratory centre recovers. When the animal has passed this stage the amount of chloroform quickly rises towards a maximum value, and an equilibrium between the various factors which determine the amount of chloroform in the blood appears to be obtained. This state persists for a considerable period, and throughout the period the differences between the amount of chloroform present in the blood and that found at the lethal point is very small. The whole of the period is dangerous and the animal may die at any point should any disturbing factor come into play. They also showed that the view of some French workers that the action of chloroform is due to its decomposition in the blood with formation of carbon monoxide is erroneous; and clearly demonstrated that the carbon monoxide, estimated by the French observers by the iodine liberated on passing the gases of the blood over heated iodine pentoxide, was due to the decomposition of the chloroform vapour, contained in the blood gases, by the alkali over which the gases were passed in order to remove carbon dioxide. In a paper on the ventilation of the lung

during chloroform anæsthesia they described a new form of plethysmograph suitable for use with cats.

In 1910, Buckmaster and Gardner were led to devise a new form of blood gas pump without taps or joints and ending in barometers, thus being entirely leak-proof. It was described in the *Journal of Physiology*, 1910, and in the same journal were published papers on the nitrogen content of blood, the gases in arterial and venous blood of cats, the composition of the blood gases in chloroform anæsthesia, and the composition of the blood gases during the respiration of oxygen.

While at Bristol, Buckmaster and Dr. Hickman made use of the same pump in an exhaustive investigation of the body fluids other than blood, particularly bile and urine.

Socially, Buckmaster was a delightful man. His superb memory, his wide knowledge of literature and his fund of stories of men and things made him an interesting and fascinating talker, while his deep sense of humour, his wit and his kindly loyalty of disposition endeared him to all who had the privilege of his friendship. J. A. G.

Prof. Alfred Lodge

ALFRED LODGE, who died at Oxford on December 1 of last year, so far outlived his contemporaries that it is scarcely possible now to see him through their eyes. Born in 1854, educated at Horncastle Grammar School and Magdalen College, Oxford, he was elected to a Fereday fellowship at St. John's College, Oxford, in 1876, and appointed in 1884 to the staff of the Royal Indian Engineering College, Coopers Hill, where he presently succeeded Wolstenholme as professor of pure mathematics; on the dissolution of the College in 1904 he became a master at Charterhouse, and there he remained until after the Great War.

Lodge's work in mathematics was all of the most elementary kind, but he was an enlightening teacher and a tireless computer. As a teacher he was active in the Association for the Improvement of Geometrical Teaching, and when that society broadened its basis to become the Mathematical Association, he was appropriately the first president to bear the new title; to the end of his life he was a familiar figure at the meetings of the Association.

As a computer, Lodge was a member for fifty years of the British Association Committee on mathematical tables, and it is in the publications of that Committee that his name will survive; if he did little to improve the technique of computing, he laboured incessantly in the practice, and work of his is incorporated in many of the reports, in the volume of miscellaneous tables published in 1931, in a factor table published in 1935, and in a volume of tables of Bessel functions which has just appeared; in addition to computing, he took a willing share in the discussions of the Committee and in the toil of proof-reading.

Sir Oliver Lodge writes of his brother, "He was . . . always willing to slave away in the background. . . . I have many dim recollections of his willing self-sacrifice for the family in early days". He was a secretary of Section A (Mathematical and Physical Sciences) of the British Association from 1888 until 1892, and from 1893 until 1896 he was recorder of the Section, a position so unusual for a mathematician that his appointment must be taken as a tribute to the confidence which he inspired; he served on the Council of the British Association from 1913 until 1915. The volume of tables of Bessel functions which has been mentioned is "Inscribed to their friend Alfred Lodge by his colleagues on the Committee" as a token of the warmest affection. These glimpses, which belong to different periods and come from different directions, converge: Alfred Lodge was a worthy member of the eminent family to which he belonged; his long life was a useful one, and he was a lovable man who was happy in being well loved. E. H. N.

Prof. Otto Warburg

PROF. O. WARBURG, who was well known as a botanist, was born in Hamburg in 1859. He travelled extensively for scientific investigation before being appointed lecturer in botany at the University of Berlin in 1891, later becoming professor in the Oriental seminary in Berlin.

Besides taking a very active interest in Zionism and affairs relating to colonization in Palestine, Warburg was the author of numerous botanical papers, particularly relating to tropical agriculture and economic botany. He was joint founder of the *Tropenpflanzer*, and was editor from its inception in 1897 until 1922, when he was succeeded by Dr. Busse. He was much interested in rubber plants and made an intensive study of the genus *Ficus*, particularly the African species, of which he described a great number, and he published, conjointly with Dr. De Wildeman, an enumeration of the *Ficus* of the Belgian Congo. His book "Die Muskatnus" (nutmegs) is a comprehensive account published in 1897, and still a standard work on the subject, and in the same year he issued a monograph of the family Myristicaceæ. For Engler's "Pflanzenreich" he was responsible for the screw pines (Pandanaceæ).

In his later life, Warburg devoted most of his time to the world Zionist movement, of which he became president in 1911. After the Great War, he was appointed head of the Agricultural Experimental Station in Palestine, being one of the founders, and he was also the director of the Institute of Natural History at the Hebrew University, Jerusalem. He was a man of great charm and of a retiring and scholarly disposition, and was revered by all sections of the Zionist movement.

WE regret to announce the following deaths:

Prof. W. H. Pickering, emeritus professor of astronomy in the Harvard College Observatory, aged seventy-nine years.

Dr. Carlotta J. Maury, palæontologist in the Brazilian Survey, formerly professor of zoology and geology in the Huguenot University College, South Africa, on January 3, aged sixty-four years.

News and Views

Aurora of January 25-26

A BRILLIANT auroral display was visible over most of England and from many places on the continent of Europe on the night of January 25–26. Dr. B. A. Keen, president of the Royal Meteorological Society, has sent the following account of the spectacle: "At Harpenden, Herts, the display was seen from 6.45 p.m. until well after midnight. The early stages appeared as a red glow in the north-west and later in the north-east, with a low broad green arc in between. The area of the luminous sky increased, and by 8.30 p.m. the green colour with areas of red extended well south of Orion. Up to 11 p.m. there seemed to be three periods of brilliant display: the first, and perhaps the best, at 7.45 p.m. when a bright red glow in the north-north-east was traversed by many sharply defined green and white shafts; at 8.30 p.m. especially in the east; and again at 9.45 p.m. when diffuse and rapidly fluctuating green streamers appeared between north-east and north-west, directed towards the zenith. Thereafter, the luminosity decreased, but as late as 11 p.m. a broad green arc stretching from north-west to north-east was still clearly visible. About midnight, a fourth display began with red streamers in the north-west, which extended until a broad red band was formed passing through the zenith to the north-east. At 1 a.m. faint red and green glows were still visible.

The Recent Sunspot and Magnetic Storms

THE large sunspot reported on p. 156 of last week's issue was easily seen with the naked eye at about the time of central meridian passage on January 18. The maximum area of the spot was more than 3,000 millionths of the sun's hemisphere; the spot is, therefore, one of the largest half-dozen spots recorded at Greenwich since 1875. As already reported, a magnetic storm was recorded at Abinger, beginning on January 16, 22½ hr. A second and larger disturbance developed rapidly on January 22 after 5 hr.; between 9 hr. and 10 hr. a range of 56′ in declination occurred, while that in horizontal force was 600γ. This range in H.F. had not been exceeded at Greenwich since the magnetic storm of May 17, 1921, but the maximum of the present period of disturbance had not been reached. On January 25 (a day after the big sunspot had disappeared over the western edge of the sun) a sudden commencement began at about noon and developed to a remarkable degree. The great aurora which followed is described above. A telephoned account of a preliminary examination of the Abinger magnetic traces stated that large movements of the recording magnets began at 17 hr. and were particularly marked between 20 hr. and 21½ hr.; the disturbance died down about 3 hr. on January 26. The total ranges during the disturbance were approximately 2·1° in declination, 1,000 γ in H and 550 γ in V. The storm is probably unequalled in the Greenwich records since that of September 25, 1909. As already stated, the big sunspot had passed off the disk on January 24 and there is no other unusual spot at present visible.

Dr. G. M. B. Dobson, F.R.S.

AT the annual general meeting of the Royal Meteorological Society held on January 19, the Symons Memorial Gold Medal awarded for distinguished work in connexion with meteorological science was presented to Dr. G. M. B. Dobson, reader in meteorology in the University of Oxford. Dr. Dobson's earlier researches related to atmospheric electricity and to the structure of the atmosphere as revealed by pilot balloon observations. In 1922, in a paper on the theory of meteors contributed to the Royal Society, Dr. Dobson, in collaboration with Prof. A. Lindemann, adduced the first reasoned evidence of the existence of high temperatures in the atmosphere above 50 km. Since 1923 he has extended most fruitfully the method of Fabry and Buisson for the study of the absorption of ultra-violet radiation in the upper atmosphere and thence the determination of the ozone content of the atmosphere. A photographic method of observation was developed and instruments were distributed to suitable observers in many countries. Later, a photo-electric method was devised to facilitate the routine measurement of atmospheric ozone. Observations made by collaborators in many parts of the world have established the nature of the variation of ozone content with season and latitude, and have revealed close relationships between the amount of ozone, the development of atmospheric pressure at sea-level and certain meteorological characteristics of the atmosphere. Further advances are to be hoped for from an extension of international co-operation in prospect.

Emmanuel Swedenborg (1688-1772)

TO-DAY world-wide celebrations are being held to commemorate the 250th anniversary of the birth of the great Swedish man of science and theologian, Emmanuel Swedenborg, who was born in Stockholm on January 29, 1688, and died in London on March 29, 1772. His death took place at 26 Great Bath Street, Clerkenwell, and he was buried in the Swedish Church, Princes Square, Stepney, whence, however, his remains were taken to Sweden in 1908. He was the second child and eldest son of Jasper Swedberg (1653–1735) a preacher, poet and visionary, who became bishop of Skara. From an early age young Swedberg, a name he bore until he was ennobled in 1719, showed unusual talent, and after studying at the University of Uppsala in 1710 came to England. He also visited France and Holland and in 1716, two years after returning home, published his "Daedalus

Hyperboreus", a kind of repository of contemporary inventions and experiments. In the same year Charles XII made him assessor in the College of Mines. His writings from that time onwards, published and unpublished, ranged over the whole field of science. In 1721 he wrote his "Prodromus Principiorum Rerum Naturalium", in 1722, a work on geology, in 1734 published in three volumes his "Opera Philosophica et Mineralia", in 1741 his "Economy of the Animal Kingdom" and in 1744–45 his "Animal Kingdom", with which his course as a natural philosopher ended. In London in 1749–56 he published his "Heavenly Arcana" and this was followed by some two score of theological works. He himself made no attempt to found a sect, but his followers established "the New Church signified by the New Jerusalem in the Revelation" and 'Swedenborgians' are to-day found all over the world.

THE removal of Swedenborg's body to Sweden in 1908 was but a part of a movement for the recognition of his genius as a man of science. In 1901 Dr. Max Neuberger, of Vienna, gave an address to an assembly of German naturalists and physicians entitled "Swedenborg's References to the Physiology of the Brain", in which he pointed out how Swedenborg had anticipated many modern discoveries. Dr. Neuberger next addressed a communication to the Academy of Sciences of Stockholm in which he expressed his regret that Swedenborg's manuscript on the brain had not been published. A committee was appointed to investigate the matter. On May 29, 1903, Prof. Gustaf Retzius, the president of the Academy, presented a report on the investigation to the Congress of Anatomists at Heidelberg. This led to a further examination of the manuscripts, and Dr. Retzius proposed that the Academy should issue an edition of Swedenborg's scientific and philosophical works. Even before this, proposals had been put forward for the founding of a museum for the preservation of portraits, relics and other Swedenborgiana. Emerson wrote of Swedenborg: "He had great modesty and gentleness of bearing. His habits were simple; he lived on bread, milk and vegetables; he lived in a house situated in a large garden. . . . He is described, when in London, as a man of a quiet, clerical habit, not averse to tea and coffee, and kind to children. He wore a sword when in full velvet dress, and whenever he walked out carried a gold-headed cane. There is a common portrait of him in antique coat and wig, but the face has a wandering or vacant air."

Scientific Delegation to India

OUR correspondent, writing from Bombay on January 15, says: "Some sixty members of the scientific delegation to India, including the president, Sir James Jeans, embarked on the S.S. *Strathaird* at Bombay on January 15 for the homeward voyage. Of these, nearly all had made the whole or part of the tour in Southern India arranged to take place after the Congress in Calcutta. This tour embraced visits to Madras, Mysore, and Bangalore, which none would willingly have missed. After a hot journey south, Madras received the delegation with a very perfect day, during which the University gave a luncheon, and most of the delegates attended a garden party arranged by the city in honour of the Viceroy. The small but very attractive aquarium, and other points of interest, were visited. The wonders of Mysore will never be forgotten by the visitors. They were received as guests of the State throughout their too short sojourn and were shown many of the institutions which are there maintained by an enlightened Government, while when darkness fell they viewed with amazement the illuminated fountains at the great power dam on the Cauvery, and the blaze of lights from the city as seen from Chamundi Hill. At Bangalore the Indian Institute of Science and other institutions were visited, and the party was entertained to tea by the Dewan Sahib of Mysore.

"AT all three cities visited during this southern tour, as indeed at every city visited throughout India, members of the delegation have freely responded to the many calls upon them for lectures, and all, whether so occupied or not, have had constant opportunity for the renewal of contacts with old students now occupying responsible positions in the places visited, and for making new acquaintanceships with workers in their various fields of interest. The whole spirit of the visit has been one of mutual and practical help, and nothing has impressed us more than the immense interest of the community in the delegation, and especially that of the students who have thronged the lectures and incidentally demanded of us inconceivable numbers of autographs. The visit has been said, by many influential Indians, to have been a great event for India: certainly it has been so for the delegation."

Museums and the Research Worker

SOME aspects of recent criticism of ethnographical collections in the museums of Great Britain are considered on p. 179 of this issue of NATURE. It cannot be emphasized too frequently that the great national collections—the question under discussion cannot affect the smaller museums except in so far as they are prepared to specialize—being supported out of public funds, it is their bounden duty to perform a function of public utility; whether that may be, as is now generally required of them, that they should take their share in making efficient and supplementing the machinery of general education, or the more highly specialized function of assisting the research worker. To the latter rather than to an attachment to a traditional system must be attributed the classificatory organization which has been subjected to criticism. For it must not be forgotten that the great national collections, as well as the smaller ethnographical museums, some highly specialized, such as the Pitt-Rivers Museum at Oxford, the Museum of Archæology and Ethnology at Cambridge, or the Manchester University Museum, have been the laboratories for the scientific researches of the

technologist in the broader sense, the student of material culture. It is upon this class of evidence that the archæologist, the ethnologist and the student of early culture generally so largely rely. In the modern museum building, however, the trend of development is to make provision for the worker in technological research by withdrawing the bulk of the material in which he is interested from public exhibition, while the public galleries are given over to the more striking objects or to those of most educative value to the public. Doubtless when more space is given to our great public collections, the same method of procedure will be followed, and the public galleries will then be devoted to regional methods of display, in so far as these may have approved themselves as the most effective for purposes of instruction.

Publication of Old Scientific Works

A SMALL committee, presided over by Prof. B. Nemeč, met at Prague on December 3 and 4 to study, on behalf of the International Organisation for Intellectual Co-operation, the possibility of publishing old scientific works. This question had been raised by Prof. Nemeč, on behalf of the Czechoslovak Research Council, and had been adopted as part of the plan of scientific work of the International Organization for Intellectual Co-operation, by the executive committee of the International Council of Scientific Unions, acting as a committee of scientific advisers. The committee at Prague unanimously agreed that it would be desirable to publish a number of manuscripts or works on the exact and natural sciences, printed copies of which are extremely rare or almost inaccessible. A series of this kind would show the common origins of modern scientific culture and would be of great value to all savants interested in the historical development of the sciences. Considering the strictly international character of the undertaking, the committee felt that it should be entrusted to the International Organisation for Intellectual Co-operation. Further, the series should not be confined to one branch of science alone and it should embrace all the periods in the development of science since the Middle Ages.

THE publications envisaged may be divided into two series: Facsimiles relating to very rare manuscripts or works containing engravings or illustrations indispensable for the value of such works; and reprints of fundamental classical works in the development of the sciences, copies of which are extremely rare or no longer obtainable, including manuscripts that have never been printed. The committee suggested the publication in facsimile of the following manuscripts in the order given: (1) "De Revolutionibus orbium coelestium", by Nicolaus Copernicus; (2) "De proprietatibus rerum", by Bartholomeus Anglicus (facsimile reproduction of the illustrations which appeared in all the editions, summary of each chapter of the original work, and a biography of the author); (3) "Micrographia", by Robert Hooke. In addition, the committee suggested the reprinting of the following very rare works and hitherto unpublished manuscripts in the order given: (1) "New System of Chemical Philosophy", by John Dalton; (2) a selection of letters from the scientific correspondence of Johannes Hevelius, astronomer and selenographer, the greater part of which is at the Bibliothèque Nationale, Paris; (3) "Opuscula Botanitii argumenti", by Rudolf Camerarius; (4) "De solido intra solidum naturaliter contento", by Nicolaus Steno; (5) "Origin of Species", by Darwin (a reprint of the first edition, 1859); (6) "Expériences pour servir à l'histoire de la génération des animaux et des plantes", by Lazaro Spallanzani; and (7) "Disquititio de sexu plantarum", by Linnæus.

Excavations in North Syria

AT the Friday evening discourse at the Royal Institution on January 21, Sir Leonard Woolley described "Excavations in North Syria". The object of the North Syrian Expedition has been to trace such relations as may have existed between Asia and the early Greek world, especially during and before the rise of the Cretan civilization. Two sites were chosen on the trade-route afforded by the Orontes valley. One was at al Mina, at the river mouth, one at Atchana in the Amk plain where the road debouches from the mountain range and runs across open country past Aleppo to Carchemish and the Mesopotamian centres. At al Mina, underlying the ruins of the crusading port of St. Simeon, there were found nine further strata giving a continuous record of commercial activity from 300 B.C. back to the beginning of the eighth century. During the fifth and fourth centuries Athens, in spite of the long-drawn crisis of the Persian wars, enjoyed a trade monopoly with Persia. In the sixth century B.C. the bulk of the trade was in the hands of the Rhodian manufacturers, but Corinth, Naukratis and Leebos secured a certain amount of it and Cyprus was still selling goods in Asia although in greatly reduced measure. In the seventh century, judging by al Mina, Cyprus entirely controlled the market; of all the imported pottery found there scarcely a sherd is not Cypriote. This domination had come about quite suddenly. It was a natural result of the wealth of the Asiatic clientele that the al Mina merchants imported always the best wares that were to be obtained; from each manufacturing centre the finest quality was selected and the centre changed according as its level of production rose or fell.

THE earlier strata of al Mina have been eroded by the river; for the period preceding the eighth century we have to look at the second site. The topmost stratum at Atchana is dated by imported Mycenæan pottery to the twelfth century B.C. In the second stratum below this, dated to the 15th–14th centuries, there are the earlier Mycenæan wares side by side with a remarkable painted pottery which is undoubtedly local, in some aspects identical with the 'Hurrian' wares found on other sites, in others altogether novel in Asia but strikingly reminiscent of Knossos. The city in which this pottery occurs, and

that beneath it, down to the Fourth Period, is Hittite; and there are Hittite inscriptions side by side with documents in cuneiform. In the Fourth Period Sir Leonard has begun to excavate a palace the architecture of which both in material and in style seems as essentially Cretan as does the painted pottery; objects in gold and ivory testify to its richness, and cuneiform tablets appear to show that it was a royal building and date it to the sixteenth century B.C. This year's season will be devoted to the clearing of the palace, and its results should certainly throw light on the connexions between Crete and the Syrian mainland.

British Archæological Investigation in France

On more than one occasion recently, French archæologists have expressed admiration for the methods of excavation followed in Great Britain on such sites as Maiden Castle and St. Albans, and at the same time have regretted that a similar procedure had not been introduced into archæological studies in France. In a recently published report (*L'Anthropologie*, **47**, 5–6) of the proceedings at the last sitting of the Commission des Monuments historiques (Section de Préhistoire) reference is made to the concession to excavate the fortified site of Artus at Huelgoat (Finistère) granted by the Commission to the Society of Antiquaries of London, of which the direction will be in the hands of Dr. R. E. Mortimer Wheeler and Mr. R. Radford. The report goes on to add that while the antiquities discovered will naturally remain the property of France, a greater gain will be the experience thus to be acquired of methods of systematic investigation, of which archæologists in France have but a very faint idea, not only as regards the work of digging but also in regard to interpretation, through the co-operation of specialists, and the supreme excellence of the planning and photography, to say nothing of the preservation of the stratigraphic record. It is, perhaps, unnecessary to add that in this international exchange the gain of Great Britain will be no less in the acquisition of systematized evidence which may be expected to throw no little light on the relation of the cultures of north-western France and the west of Britain in prehistoric times—a relation which recent discovery suggests may have been even closer than has hitherto been anticipated.

International Telecommunications Conference at Cairo

Radio communication is essentially an international affair, and it is therefore necessary that it shall be conducted according to rules and conventions agreed to by all the principal countries in the world. The necessary regulations are drawn up by international conferences which are held at intervals of about five years and are attended by delegations from the administrations operating the radio services in the various countries. These conferences are organized by the International Telecommunications Union, with headquarters at Berne, Switzerland, the function of which is to co-ordinate telecommunication of all types, telegraph and telephone, cable, wire and radio. At the present time, world radio communication is being conducted under the Madrid Convention which was drawn up at the end of 1932.

On February 1, a new conference will be opened in Cairo with the object of revising the existing convention in the light of progress and developments in the past five years. During this period, the technical aspects of the various questions involved have been studied by international technical committees, such as the Comité Consultatif International des Radiocommunications (C.C.I.R.), which last met at Bucharest in May–June 1937. The general objective of these committees and of the Cairo conference is to revise the existing convention in such a manner as to place telecommunications on the most efficient and equitable basis for the world as a whole. On the radio side, considerable attention is given to the allocation of wave-bands among the claimants representing the various interests involved, which range from commercial services and defence requirements through broadcasting to various scientific and experimental interests. The Cairo Conference is expected to last from six to twelve weeks, and the application of the results may require a year or more to put into effect, so that ample time is provided for industry and the users of communications to prepare for such changes as may be involved.

British Snowfall Survey

At the first meeting of the International Snow Commission held in Edinburgh on September 14–16, 1936, members of the British group emphasized the importance of snowfall in the hilly districts of the British Isles, pointing out, also, that if the climate were to take a slightly colder turn the snowfall would become decidedly impressive over a large portion of the country. Out of this meeting there arose the formation of the Association for the Study of Snow and Ice, and among other activities of this body a scheme has been launched for extending our knowledge of snowfall in Great Britain from observations of the extent, duration and depth of snow-cover. It is thought desirable to begin systematic study with limited areas in such snowy districts as the Cairngorms, the Southern Uplands of Scotland and the northern Pennines, gradually extending the scheme to cover the whole of the country. It is hoped to investigate the permanent, semi-permanent and late-lingering snow-drifts in the Scottish Highlands, and the northern English and Welsh mountains, together with such important phenomena as the long-distance, mass-drifting of snow whereby quantities of snow in severe blizzards may pass out of the drainage basins into which, but for the wind, they would have fallen. The plan will thus supplement valuable information already being obtained from the rainfall stations of the Meteorological Office, and readers interested should communicate in the first instance with the chairman of the Ice and Snow Association, Mr. Gerald Seligman, at Warren Close, Coombe Hill Road, Kingston Hill, Surrey.

Pacific Entomological Survey

ON November 2, 1932, a statement of the work and objects of the Pacific Entomological Survey was made before the Royal Entomological Society of London, as a result of which a resolution was passed unanimously inviting Dr. S. A. Neave to write and commend the work in the name of this Society, of which he later became president. On November 26 of the same year an appeal was issued in NATURE (130, 802–3; 1932), and further generous support was, despite the depression, forthcoming from various sources in Hawaii and elsewhere. Then, in 1935–37, liberal grants through the trustees of the will of the late Viscount Leverhulme and through the British Museum (Natural History) enabled Mr. E. P. Mumford, director of the Survey, to accept Sir Edward Poulton's invitation to complete the present phase of the work in the Oxford University Museum, where Sir Edward's successor, Prof. G. D. Hale Carpenter, is extending the hospitality of the Hope Department. The work of the Survey is of interest to all countries the territories of which either surround or extend into the Pacific, for, as Dr. Neave points out in the letter referred to above, "a knowledge of the fauna of all the Pacific Islands may well be of the utmost value in the more cultivated and developed ones, in that it may give a clue to the origin of many of the local pests of the latter, and thus point to opportunities for devising their biological control".

THE work of the Survey is already well advanced, and some 150 papers have been submitted for publication in Hawaii and elsewhere. It was originally proposed to prepare for publication a résumé and analysis of the findings of the Survey, and a discussion of the bearings thereof on the problems of distribution of insects in the Pacific, but it is becoming increasingly apparent as a result of the researches in Oxford that such an analysis will, to be of any value, have to take into account, not only the fauna of the islands of the Pacific, but also that of other islands. In reviewing (NATURE, 130, 797; 1932) a manuscript copy of "Entomological Researches in the Marquesas Islands" (afterwards published in V^e Congrès International d'Entomologie, pp. 431–450, Paris, 1933), Dr. Hugh Scott referred to certain groups that are said to be absent from the Marquesas, and stated that the authors, Messrs. Mumford and Adamson, regarded these gaps in the fauna as strong evidence against the existence in past ages of extensive land areas in the Pacific, but, as Dr. Scott points out, some of these groups are also absent from the faunas of islands not of volcanic and purely oceanic origin. Furthermore, some of these groups that are thought to be absent from the Marquesas have been taken in supposedly oceanic islands elsewhere. Though Cicadas are unknown in the Marquesas, a remarkable genus has been described from Samoa, which island group Prof. Buxton considers to be oceanic. Caddis-flies and may-flies, supposedly absent from the Marquesas, have been taken in Samoa as well as in the 'crypto-oceanic' Canary Islands and Madeira, and froghoppers, which were not met with by Messrs. Mumford and Adamson in the Marquesas, are known from Tonga, Samoa, the Society Islands, and Rapa. In bringing these extensive studies to a focus in Oxford, and at Farnham House Laboratory by courtesy of Dr. Thompson, Mr. Mumford and his assistants have received every assistance and co-operation from specialists throughout the world. Correspondence concerning island faunas may be addressed to the Hope Department of Zoology (Entomology), University Museum, Oxford.

Progress towards Internationalism

THE October–January number of *Science and Society* is devoted to a discussion of the conditions of progress towards internationalism. Prof. E. Jäckh, in an article on "The Changing International Relations", stresses the necessity of development into supra-national relations. Supra-national science has made possible and indeed necessary the organization of an international society. The tempo of such development, in which science shows the way, is determined by the extent to which humanity values technical civilization, science and their world-changing effect as bursting asunder the frontiers between peoples. Prof. H. J. Fleure contributes an article on "Society and Liberty" in which he shows that society must be studied ecologically with a deep realization that no one has the whole truth; we are all seekers, and the truth is far above us all. He urges that it is our duty, in the name of science, to plead for freedom of conscience not only as an essential for scientific thought, but also as the only way in which in the long run society can keep in touch with the ever-flowing changes in the world. "Anthropology and racialism" is the subject of an article by J. C. Trevor, who, directing attention to some of the inherent difficulties in the consideration of problems of race, points out the danger to world peace which the accentuation of racial disparities may offer if identified with nationalistic aspirations.

ADRIAN STEPHEN's article on "War and Emotional Development" discusses some difficulties in a supra-national authority and suggests that a hopeful line of progress lies in learning to regard countries or nations as pieces of machinery with definite functions for the promotion of human happiness rather than as idealized mothers and fathers. The application of science to political and international affairs at the present juncture is urged by C. A. Mace, in a thoughtful article "Planning Peace", to be less a matter of using specific material from the relevant social sciences than of infusing politics with some respect for the scientific spirit and the scientific point of view. Mr. Mace stresses the need for a system of publication, without fear or favour, of tested matters of fact, as essential to restore public confidence and to give intelligence to public judgment. R. H. Pender's survey of the political phases of Western Society leads him to the conclusion that any re-integration of society has to be achieved consciously

and can only be tackled after an adequate idea of the nature of a society has been gained. This is in the first place a task for social science, since science alone has sufficient authority to get its conclusions adopted universally as a basis for action.

Science and University Teaching

AN article by Dr. W. H. George on "Science and University Teaching" in the *New University* of November, emphasizing the value of the widespread use of scientific methods in dealing with the social problems of to-day, points out that an education which includes one or more sciences does not necessarily foster scientific action. Even a knowledge of science up to university degree standard does not necessarily guarantee ability to think or act scientifically within the scope of the sciences studied. While, however, teaching is the best way of promoting the use of the scientific method, Dr. George points out that, in general, science but no scientific method is taught to science students and that scientific method, but no science, is taught to a small proportion of arts students and this teaching is separated from that of the student's main subject of study.

National Forest Park near Snowdon

A COMMITTEE was appointed by the Forestry Commissioners on March 31 last to advise as to the steps which might be taken to form a national forest park on their properties in the vicinity of Snowdonia. It has now issued its report on the "National Forest Park Committee" (H.M. Stationery Office, 1937). The Forestry Commissioners had expressed an intention of designating areas, such as the one here under consideration, 'National Forest Parks'. It is pointed out that this type of park has no affinity with the 'National Park' as described in the report of the National Park Committee. The area here in question is the Gwydyr Forest of about 18,000 acres. The Forest forms a fringe of the wild and open mountain land culminating with the Snowdon range with its large stretches of foothills and rough grass, heather and rock-strewn spaces. The central Snowdon region is mostly in private ownership. The land in Gwydyr Forest which has been, or will be, planted by the Forestry Commissioners comprises about three-quarters of the area and forms the lower slopes on the east and south-east of the Snowdon range, in which group of mountains is included the Glyders and Carnedd mountains. There are numerous roads, tracks and footpaths, many of which afford delightful walks, climbs and views. The district includes some of the finest mountain scenery in North Wales and attracts a very large number of holiday-makers in the summer. The larger part of the Forest is held by the Commissioners on long leases subject to certain reservations. Local hostels exist, and certain other facilities in this respect and camping facilities are recommended, it being suggested that Government be asked to provide funds for the Commissioners' use in these developments. Such funds should surely be obtainable from the region which will benefit by the provision of this national forest park.

Acquisitions at the British Museum (Natural History)

AMONG the specimens presented to the Department of Mineralogy of the British Museum (Natural History) is a collection of about three hundred rock and mineral specimens, made by Mr. H. St. J. B. Philby, between Mecca and Mukalla, during his last journey of exploration through West and South-West Arabia. The collection is not only of academic interest. There is evidence of the presence of oil in the richly bituminous limestones and oil-soaked shales outcropping in the neighbourhood of Shabwa, and farther north, near Jizan, Mr. Philby collected specimens of hæmatite, an important iron-ore. This mineral is also present in several quartz-reefs, of which he brought back samples. By his careful and complete field-records of each occurring type, Mr. Philby has brought to light a number of salient features in the geological structure of a region previously unknown to Europeans, and has made it possible to prepare an approximate geological map of the region through which he travelled.

Vital Statistics in Great Britain

ACCORDING to a return published by the Registrar-General, the birth-rate in England and Wales during the year 1937 is provisionally estimated at 14·9 live births per thousand of the population, and the crude death-rate at 12·4 deaths per thousand of the population. The number of deaths of children under one year, per 1000 live births, was 58. The birth-rate for 1937 is 0·1 above that for 1936, 0·2 above that for 1935 and 0·5 above that for 1933—the lowest on record. The crude death-rate is the highest recorded since 1929 and is 0·3 above that of 1936, an increase which is largely associated with the heavy influenza mortality of the first quarter of the year. The infant mortality is 1 below that of 1936, and only 1 above that of 1935—the lowest recorded.

Rheumatic Fever as a Protozoal Disease

DR. G. ARBOUR STEPHENS, 61 Walter Road, Swansea, referring to a recent Colonial Office Medical Report on the Falkland Islands, states that although the weather there is described as very damp and "permanent October" weather, and although the houses are damp, the soil acid, the food so poor that the school children wear dentures, and septic tonsillitis (due to *Streptococcus*) is so common, nevertheless rheumatic fever does not occur. This, he claims, supports the view that rheumatic fever is due to a protozoon (something like the malarial parasite), for the necessary insect carriers, such as harvest bugs, midges and fleas do not exist on the Islands.

Current Titles

WE have received the first part of a new monthly journal, *Current Titles*, published by Engineering Journals, 928 Broadway, New York, the subscription being 3 dollars yearly (4 dollars outside the United States). The journal gives the tables of contents of a large number of scientific, technical and engineering journals in English. We note that these include

Government publications, and that geology, physics, metallurgy and chemistry are well covered; biology is not dealt with, as there is a similar journal in this field. The new journal will serve a very useful purpose, since it gives at a glance the titles of papers in a wide field. The format is very convenient.

Fifth Glass Convention

THE fifth Glass Convention will be held at the Norbury House Hotel, Droitwich, on May 18–21 under the presidency of Mr. H. S. Williams-Thomas. This year will be an important one in the history of the British glass industry because in London the Society of Glass Technology has just concluded its twenty-first anniversary celebrations, and in April the *Daily Mail* Ideal Home Exhibition at Olympia will have glass as its outstanding motive. A subject which is engaging the attention of industrialists at the moment is the trade cycle, on which Mr. Harold Macmillan, M.P., will speak during one of the business sessions. Mr. Ronald Cartland, M.P., will give an address on "Recent Industrial Legislation". The presidential address will be entitled "Craftsmanship in Industry". Prof. W. E. S. Turner will lead the discussion on the presidential address. Of no less interest are the technical sessions arranged by the Society of Glass Technology, the subjects being "Glass Finishing Processes" and "Plastics and their Relation to the Glass Industry".

Announcements

SIR JOHN SNELL, chairman of the Electricity Commission, has been awarded the Faraday Medal of the Institution of Electrical Engineers. The Medal is awarded once a year either for notable scientific or industrial achievement in electrical engineering or for conspicuous service rendered to the advancement of electrical science, without restriction as regards nationality, country of residence, or membership of the institution. Mr. Frank Gill, past president of the Institution, has been elected an honorary member of the Council of the Institution.

THE Messel Medal of the Society of Chemical Industry has been awarded to Prof. L. H. Baekeland, honorary professor of chemical engineering in Columbia University. Prof. L. H. Baekeland is the founder of the plastics industry and his own name is perpetuated in the well-known commodity 'Bakelite'. He was also responsible for the 'Velox' patents used in modern photographic industry. The Messel Medal is awarded every two years for meritorious distinction in science and its application to industry.

DR. E. W. RUSSELL has been appointed Goldsmiths' Company's soil physicist at the Rothamsted Experimental Station in succession to Dr. G. W. Scott Blair, who has been appointed head of the Dairy Chemistry Department at the National Institute for Research in Dairying, Shinfield, Reading. Dr. Russell studied soil science at Zurich under Prof. Wiegner and in Russia under Prof. Polynov; for the past few years he has been assistant in the Soil Physics Department, Rothamsted, and has published various papers on soil texture.

AT the annual general meeting of the Royal Meteorological Society on January 19, Dr. B. A. Keen, assistant director, Rothamsted Experimental Station, Harpenden, was elected president in succession to Dr. F. J. W. Whipple. Other officers elected include: *Secretaries*, H. W. L. Absalom, W. Dunbar, E. L. Hawke; *Treasurer*, W. M. Witchell; *New Members of Council*, C. E. Britton, Dr. R. F. Fox, Major H. C. Gunton, R. S. Read, Gerald Seligman and Dr. R. C. Sutcliffe.

THE following have been elected officers of the Royal Microscopical Society for the present year: *President*: J. E. Barnard; *Hon. Treasurer*: C. F. Hill; *Hon. Secretaries*: Prof. R. T. Hewlett and J. Smiles; *New Members of Council*: Dr. J. A. Murray, J. H. Pledge, T. E. Wallis and S. R. Wycherley; *Hon. Editor*: Dr. G. M. Findlay; *Hon. Librarian*: Dr. C. Tierney; *Hon. Curator of Instruments*: M. T. Denne; *Hon. Curator of Slides*: N. Ingram Hendey.

THE forty-first Bedson Lecture will be delivered by Prof. J. Kenner, professor of technological chemistry, University of Manchester, at King's College, Newcastle-upon-Tyne, on Friday, February 4. Prof. Kenner will take as his subject "Aliphatic Diazo Compounds".

PROF. BERNARD NOCHT of Hamburg has been awarded the shield of nobility of the German Reich.

PROF. RICHARD KUHN, director of the Kaiser Wilhelm Institute for Medical Research at Heidelberg, and Dr. Ernst Späth, professor of chemistry at Vienna, have been elected honorary members of the Société de Chimie Industrielle of Paris.

PROF. MAX EUGLING, who is well known for his climatic and hydrological researches, has succeeded Prof. Grassberger as chief of the Institute of Hygiene of the University of Vienna, where he has been assistant for the last thirty years.

THE second Darling prize of the League of Nations for original work on malaria published during the previous five years has been awarded to Prof. N. H. Swellengrebel, professor of tropical parasitology at Amsterdam, and will be awarded to him during the Third International Congress on Malariology in September 1938.

THE Association for Education in Citizenship has arranged a secondary school conference on methods of training for the responsibilities of citizenship, to be held at Morley College, Westminster Bridge Road, London, S.E.1, on March 4–6. Applications to attend the conference, accompanied by a fee of 5*s*., should reach the secretary of the Association, 10 Victoria Street, London, S.W.1, not later than February 5.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 207.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Nuclear Transformation by *K*-Electron Capture

THE theoretical expectation that a nucleus which emits positive electrons may, as an alternative mode of transformation, change by capturing a *K*-electron, was recently demonstrated experimentally by Alvarez[1], who was able to detect by means of a counter arrangement the fluorescent X-radiation which follows *K*-capture. Earlier experiments by Jacobsen[2], using an active isotope of scandium in an expansion chamber, had not shown any evidence of such fluorescent radiation. Alvarez's observations were made on titanium which had been bombarded by fast deuterons. Walke[3] had previously shown that one of the products of the bombardment is an isotope of vanadium, of mass number 48 and half-life 16 days, which emits positrons and thus transforms to ^{48}Ti. Alvarez concluded from his experiments that ^{48}V also transforms to ^{48}Ti by the capture of a *K*-electron, the two modes of transformation being about equally probable.

We have recently been able, through the kindness of Mr. Walke, to examine, in the expansion chamber, the activity of a specimen of titanium which had been bombarded by fast deuterons about five months ago. (This source was activated in the Radiation Laboratory, Berkeley, and was a gift to Mr. Walke from Prof. E. O. Lawrence.) The photographs obtained showed a number of tracks due to negative electrons, but very few due to positive electrons. When a magnetic field was applied to bend away these electrons, a large number of very short tracks was observed. These tracks show that a soft X-radiation is emitted from the titanium specimen, indicating, in a striking way, a *K*-capture transformation. The energy of the photo-electrons produced by the *K*-radiation of titanium (or of a neighbouring element) is only about 4,000 volts, so that their tracks appear as spots in the photographs. In the photograph reproduced here there are about 300 of these short tracks.

The photographs show the decrease in intensity of the radiation due to absorption in the gas of the chamber. This gas was oxygen at a pressure of 66 cm., which for titanium *K*-radiation has a linear absorption coefficient of about 0·07 cm.$^{-1}$. Preliminary counts of the spots in photographs taken with a collimated source, to avoid errors due to the limited depth of focus, gave an absorption roughly in accordance with this, indicating, actually, a parent atom of atomic number 21 ± 1 (Ti = 22). Further experiments will enable us to decide definitely the atomic number of the element responsible for the radiation.

The noteworthy feature of this example of *K*-capture is its large probability compared with that of the alternative process of positron emission. Indeed, unless positrons of very low energy are emitted, this ratio is of the order of 1000 : 1. Even this estimate assumes that the few positrons observed represent the same nuclear transformation. This may well not be the case, and it is not unlikely that the transformation by positron emission is energetically impossible (its threshold being about $2\,mc^2$ higher than that for *K*-capture).

In Alvarez's experiments on newly activated titanium, the number of *K*-captures was approximately equal to the number of positrons from ^{49}Ti. The latter decays with a period of 16 days and would thus have now about 1/1000 of its initial activity. The fact that we find about 1 positron for every 1000 *K*-captures is not inconsistent with Alvarez's results if we assume that the positrons are due to ^{49}Ti and the *K*-capture to a nucleus with a very long period. We should also mention that the recoil electrons produced by the γ-rays from the present source bear a much smaller ratio to the fluorescent quanta than in Alvarez's experiments, indicating that the bulk of the initial γ-ray activity is not associated with the *K*-capture process. Further observations will be made to elucidate the origin of the various radiations emitted by the source.

E. J. WILLIAMS.
E. PICKUP.

George Holt Physics Laboratory,
University, Liverpool.
Dec. 22.

[1] Alvarez, L. W., *Phys. Rev.*, **52**, 134 (1937).
[2] Jacobsen, J. C., NATURE, **139**, 879 (1937).
[3] Walke, H., *Phys. Rev.*, **51**, 1011 (1937).

Altitude Effects in the Red Part of the Auroral Spectrum and the Two Types of Red Auroras

IN a previous note in NATURE[1], I described observations made at Oslo of an auroral display which showed red upper limits, while the lower part had the ordinary greenish-yellow colour. Spectroscopic observations gave an enormous enhancement of the red oxygen line 6300 with increasing height. In a later paper[2], I described quantitative measurements of spectrograms corresponding to auroras of ordinary colour, which also gave a considerable enhancement of the red line 6300 with increasing altitude. It became a matter of importance to make further measurements in order to see if the altitude effect on the red line was a general occurrence.

During auroral displays which were observed at Oslo on the two nights of October 11–13, 1937, I obtained on panchromatic plates four pairs of spectrograms. For each pair the spectrograms were taken as quickly as possible in succession, one from the lower, the second from the upper limit of the auroral streamers. Photometer curves of the spectrograms covering the red part and the green line 5577 are shown in the accompanying illustration. The first pair, I, was taken on the evening of October 11, the other three pairs II, III, IV during the following night.

Although the relative intensity of the red line is very different for different pairs, we find that *for each pair the relative intensity of the red line increases as we pass upwards from the lower to the upper limit.* By means of an intensity scale taken by means of a light source of known intensity distribution, we found the following intensities (I_r) of the red line relative to the green one:

Pair	I_r (upper)	I_r (lower)	$\frac{I_r \text{ (upper)}}{I_r \text{ (lower)}}$
I	2·74	1·15	2·38
II	0·82	0·60	1·37
III	0·75	0·36	2·08
IV	1·07	0·34	3·15

Mean, 2·25

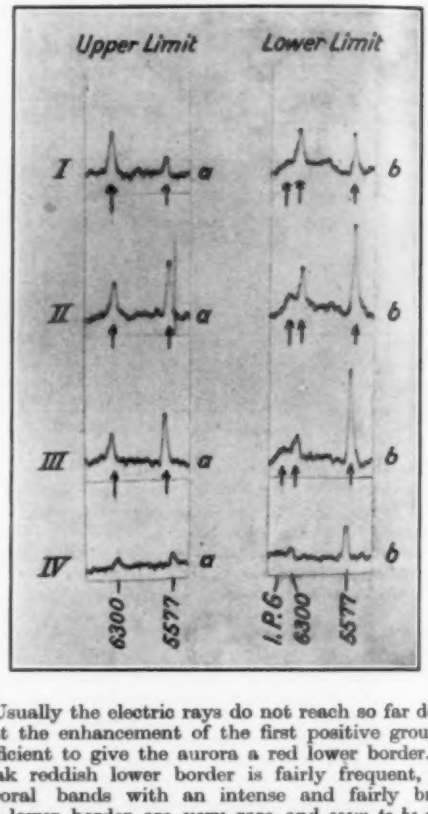
On an average, the relative intensity of the red line at the upper limit is 2·25 times that at the lower.

The numbers also confirm the result previously described[2] that the red line 6300 may obtain an intensity considerably greater than that of the green line, a result which shows that the $^1D_2$-state is excited by a certain process, which acts independently of that which excites the $^1S_0$-state, and which results in the emission of the green line.

The photometer curves for the lower limit all show distinctly the bands of the first positive group, while these bands are absent on all the curves corresponding to the upper limits showing the existence of a pronounced altitude effect of the first positive group, and in such a way that its intensity relative to that of the green line *increases as we pass downwards in the auroral region.* The altitude effects of the red line 6300 and of the first positive group have an interesting bearing on the two types of red auroras called *A* and *B*.

As I have shown, the red colour of type *A* is due to the enhancement of the red line 6300, which is particularly prominent during sunspot maxima and when the atmosphere is exposed to sunlight.[3] *The altitude effect of this line means that this type of red aurora has a tendency to be more intensively red towards the upper limits of the streamers.* The enhancement is shown to be due to an excitation process which brings the O-atom directly to the $^1D_2$-state, and this process is associated with some component of the atmosphere formed by the action of short-wave radiation from the sun. This component is probably ozone, and the $^1D_2$-state is excited through collisions between ozone molecules and nitrogen molecules in the metastable $A(^3\Sigma)$-state (cf. ref. 2).

Type *B* is characterized by an intense red colour along the *lower border* and was shown to be due to the enhancement of the first positive group, which is particularly pronounced when the aurora reaches a very low altitude. The results given in this note show that the enhancement is not restricted to regions near the lower limit, but *the first positive group shows a gradual enhancement as we pass from the upper limit downwards.*



Usually the electric rays do not reach so far down that the enhancement of the first positive group is sufficient to give the aurora a red lower border. A weak reddish lower border is fairly frequent, but auroral bands with an intense and fairly broad red lower border are very rare and *seem to be most frequent at times of sunspot minima*[4], showing that the electric rays obtain the greatest maximum energy at sunspot minima.

L. VEGARD.

Physical Institute,
Oslo.
Dec. 15.

[1] Vegard, L., NATURE, **138**, 930 (1936).
[2] Vegard, L., *Z. Phys.*, **106**, 108 (1937).
[3] Vegard and Tönsberg, NATURE, **137**, 778 (1936).
[4] Vegard, L., *Geophys. Pub.*, **10**, No. 4 (1933).

Origins of the Zodiacal Light

I REFER to an important paper[1] by Prof. H. P. Robertson of Princeton, tracing out the effects of the Poynting principle of suction of fine orbital dust or gas into the sun or other strongly radiating star. It concerns me directly as in an amendment of the numerical factor for the reprint in Poynting's "Collected Papers" I inadvertently doubled the final value by adding the effects in the two frames of reference, that of the sun and that of the orbital particle, instead of taking them as alternative.

There could not be a permanent zodiacal light at all unless the particles that deflect it were sustained against falling into the sun, and that could only be by an orbital motion of planetary type for each particle, whose centrifugal influence holds it up against gravitation to the sun. The perhaps unexpected result is here involved that the rather thick disk around the sun, extending beyond the earth's orbit, which shines permanently throughout astronomical times, must be a residue of the original whirling solar nebula, which its presence indeed goes far to establish: for it can scarcely be conceived as formed by ejection of particles nearly tangentially from the sun's surface. Perhaps this arresting conclusion may not really be unfamiliar: Poynting had possibly known of it. The radiation incident from the sun exerts according to his principle a dynamical retardation which gradually converges each orbit spirally into the sun in a time not great on the astronomical scale, provided, however, the particles are not large compared with the wave-length of the radiation. This gradual subsidence demands a renewal from outside, in a steady stream, which is more rapid and so less dense for the smaller particles or gaseous atoms and ions. The particles must not collide as in a gas, else all would be broken up soon, and the gas ultimately sustained otherwise as a close-fitting atmosphere in Maxwellian manner.

Thus we are led to contemplate a nebula surrounding the sun, which has now become of the type of the rings of Saturn, but enormously less close packed. This favouring paucity of collisions is reasonable if only on account of the extreme tenuity of the distribution, like that in a comet's tail, the mean distances of neighbouring particles being comparable with miles. The mode of slow subsidence of a gaseous rotating nebula of this non-colliding type would perhaps be an interesting subject for mathematical analysis after the manner of the Saturn ring theory, conceivably even connecting up with a distribution of atoms not entirely negligible throughout the depths of space.

The immediate cause of this note is, however, a recent announcement from the MacDonald Observatory in Texas by C. T. Elvey and P. Rudnick[2] that the zodiacal light is ordinary reflected sunlight and shows no sensible proportion of a Stokes-Rayleigh scattering such as produces the blue sky. This shows, as they remark, that the particles which mainly deflect it have dimensions of the order of several wave-lengths at least. We note here in confirmation that by the Poynting analysis, smaller particles would, as *supra*, be sucked into the sun far more rapidly and be gradually winnowed out, more rapidly the nearer the sun, and therefore for given influx from beyond the replenishing stream would have far smaller density: the distribution of the larger particles would, in fact, require little replenishment, but could scarcely extend out indefinitely.

Diffuse nebulæ are held likewise to shine by illumination from blazing stars located in front of them, because they send the same kind of light; but for them the sideway scattered bluer light would have little chance of being important. No inference as to size of particles in these nebula would thus arise. This perhaps clears up the general question of colour in nebular cosmogony. The inference from colour as regards the zodiacal light would likewise be vitiated if the effective length of the source that is in the line of sight is large compared with distance of that line from the sun, which may be not improbable. But however that be, the Poynting dynamical train of reasoning here presented for the solar nebula would remain firm.

JOSEPH LARMOR.

Holywood,
N. Ireland.
Jan. 5.

[1] *Mon. Not. Roy. Astro. Soc.*, **97**, 423–38 (1937).
[2] *Astrophys. J.*, Oct. 1937, as quoted in *Science Abstracts*, Dec. 1937.

The Liquid State of the Primitive Earth

IT has often been suggested that the earth must have been in a liquid state at an epoch near the very beginning of its formation. I wish to give an argument which confirms this view. If we suppose that the earth was originally in a gaseous state, we can imagine a model, which we call the globe, defined as a polytropic gas sphere of mass 6×10^{27} gm., equal to the present mass of the earth. Assuming (following Jeffreys) that the central temperature must have been equal to the effective temperature of the sun at the time of formation, that is, about 6000° K., and considering the polytropic indices $n = 3$, 1 or $\frac{1}{2}$, one finds a radius of $2{\cdot}2 \times 10^{10}$, $1{\cdot}28 \times 10^{10}$ or $1{\cdot}24 \times 10^{10}$ cm. The smaller values of n correspond to a lower compressibility than is generally assumed for the stars (Eddington). The values of the density are such that the material of the globe is very nearly a perfect gas. The pressure and temperature in the globe can then be calculated from Emden's tables, as functions of the distance from the centre.

On the other hand, by means of the Clapeyron-Clausius law, one can estimate the boiling temperature of the metallic vapours as a function of the pressure, and consequently as a function of the distance from the centre in the globe.

If the polytropic temperature and the boiling temperature of iron (the most abundant metal) are plotted against this distance, it is found that in a thick outer layer of the globe, the conditions are such that the iron must condense into liquid metal and consequently precipitate in drops towards the centre. Any other reasonable choice of the characteristics of the globe such as would give a good model of the earth leads to the same conclusion. This condensation may be considered as spontaneous. The thickness of the layer is about $\frac{1}{4}$ of the radius of the globe for $n = 3$, and about $\frac{1}{3}$ for $n = 1$ and $n = \frac{1}{2}$.

This conclusion provides an explanation of the occurrence of the iron core which is generally regarded as occupying the centre of the earth.

A full account of this theory will appear shortly in the *Archives des Sciences physiques et naturelles*.

ANDRÉ MERCIER.

Institut for teoretisk Fysik,
Copenhagen.
Dec. 2.

Westward Extension of the Ranikot Sea

IN a previous letter[1] I showed that the Ranikot (Palæocene) Sea of India must have extended over the whole length of the Himalayas, from eastern Tibet to Waziristan. More recently, some interesting fresh evidence has been found regarding the extent of the Ranikot Sea; for Mr. A. G. Davis, who is working for the Anglo-Iranian Oil Company, informed me that he had found Ranikot fossils in collections made by Dr. J. V. Harrison of that Company from a section near Shamshir-i-Quli (lat. 33° 30′ N.; long. 47° 10′ E.) on the western borders of Persia.

These collections Mr. Davis has since shown to me, and I have been able to confirm his opinion, identifying the following species as present: *Nummulites nuttalli* Davies, *N. thalicus* Davies, *Operculinoides* cf. *sindensis* Davies, *Miscellanea stampi* Davies, *M. miscella* D'arch. and Haime, *Sakesaria* cf. *cotteri* Davies and *Alveolina globosa* Leymerie. The thickness of Upper Ranikot beds at Shamshir-i-Quli is at least 500 feet; and the succeeding less fossiliferous beds, with forms which I referred to *Alveolina lepidula* Schwager, *A.* cf. *oblonga* D'Orbigny and *Orbitolites* cf. *complanatus* Lamarck, would seem to be of Laki age. Although true Ranikot fossils have not yet been found in any other collections received by Mr. Davis, the existence of the Ranikot at Shamshir-i-Quli is unquestionable.

The occurrence is worth recording, since Ranikot beds have never before been certainly located much farther west than long. 68° E. Taken in conjunction with my discovery[2] last year of an abundant Upper Ranikot fauna in Sir Henry Hayden's collections from Kampa Dzong, due north of Calcutta, this last discovery shows that the Upper Ranikot Sea extended in an east-to-west direction from the vicinity of Lhasa to that of Bagdad.

I am indebted, for permission to publish these facts, to the courtesy of the Anglo-Iranian Oil Company.

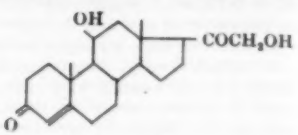
L. M. DAVIES.

8 Garscube Terrace,
Edinburgh, 12.
Dec. 24.

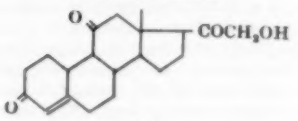
[1] "Extent of the Ranikot Sea", NATURE, **139**, 414–415 (1937).
[2] "Eocene Beds of the Punjab Salt Range", *Pal. Indica* (N.S.), **24** Mem. 1, Appendix, 68–71 (1937).

Chemical Structure of Corticosterone

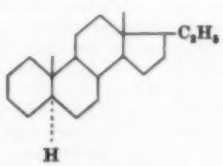
THE adrenal gland produces a hormone which is essential to life. During the last two years, several workers have succeeded in isolating, from purified preparations of the cortical hormone, a number of crystalline compounds. Among these substances corticosterone and dehydro-corticosterone possess the greatest biological activity. The structures (I) and (II) were proposed for corticosterone and its dehydro-derivative[1,2]. These formulæ were not definitely proved, but were chiefly based on the assumption that corticosterone might possess a constitution similar to some of the above-mentioned compounds, which have been isolated from the adrenal gland and which have been found to contain one more atom of oxygen in their molecules. These substances, which can be designated as the C_{21}-O_5-group, contain the sterol ring-system since they can be converted into the hydrocarbon androstane[3]. The suggestion that corticosterone contains the same ring-system has so far not been supported by any experimental evidence.



(I)
Corticosterone



(II)



(III)
Allo-pregnane

By means of a series of reactions, the details of which will be published in the *Helv. chim. Acta*, corticosterone can be transformed into the hydrocarbon allo-pregnane (III) (m.p. 84°, $[\alpha]_D^{21} = +12{\cdot}7°$ in chloroform). The same hydrocarbon was also obtained by a Clemmensen reduction of allo-pregnane-dione-3·20[4]. This evidence appears, therefore, to prove the presence of a steroid structure in corticosterone.

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T. REICHSTEIN.

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Eidg. Techn. Hochschule,
Zurich.
Dec. 18.

[1] Kendall, E. C., Mason, H. L., Hoehn, W. M., McKenzie, B. F., *Proc. Staff Meet. Mayo Clinic*, **12**, 136 (1937). *J. Biol. Chem.*, **120**, 719 (1937).
[2] Reichstein, T., *Helv. chim. Acta*, **20**, 953 (1937).
[3] Reichstein, T., *Helv. chim. Acta*, **19**, 979 (1936); **20**, 978 (1937). Steiger, M., and Reichstein, T., *Helv. chim. Acta*, **20**, 817 (1937).
[4] Butenandt, A., und Westphal, U., *Ber. deut. chem. Ges.*, **67**, 1440 (1934). Butenandt, A., Westphal, U., und Hohlweg, W., *Z. physiol. Chem.*, **227**, 84 (1934).

Treatment with Ascorbic Acid of the Plasma of a Fowl affected by Erythroblastosis

IN the course of researches aiming at investigating the nature of the virus of aviary erythroblastosis, the following observations were made.

By adding to the plasma (plus sodium oxalate) of a fowl seriously affected by erythroblastosis (O. G. strain which we owe to the kindness of Prof. Oberling) ascorbic acid in determinate proportions, a turbidness was noticed in the plasma itself which, after having been kept in the ice-chest for some hours, became transformed into a precipitate. 0·1 gm. of ascorbic acid was dissolved in an 8 per cent sodium chloride solution. This solution was added to the plasma *as soon as the ascorbic acid was dissolved*. The final concentration of ascorbic acid in respect to the plasma was 1 : 150.

The following tests were made:

(1) Comparison of the activity of the plasma injected immediately after the ascorbic acid had been added with the same plasma not treated. *It was seen that the activity was not appreciably modified.*

(2) Comparison of the activity of the two fractions obtained from the plasma after treatment with ascorbic acid; kept in the ice-chest for three hours and centrifugal separation of the precipitate from the liquid above it. (The precipitate was washed on the surface with saline solution.)

Supernatant fluid	Precipitate
Animals inoculated	Animals inoculated
(1) died of erythroblastosis after 9 days	(1) survives
(2) " " " " 12 "	(2) "
(3) " " " " 14 "	(3) "
(4) " " " " 17 "	(4) "

(3) Comparison of the activity of the fraction obtained after treatment of the plasma with ascorbic acid and elimination of the precipitate in the way mentioned above, with the same plasma not so treated.

Plasma (+ oxalate) not treated			Ascorbic acid plasma supernatant fluid		
Animals treated	Positives	Average time of survival of positives	Animals treated	Positives	Average time of survival of positives
21	15	19 days	21	19	15 days

It seems, therefore, that the activity of the plasma treated with ascorbic acid (contrary to the results obtained by Claude[1,2] by acidification with other acids of watery extracts of Rous's sarcoma) remains altogether in the supernatant fluid; and indeed, the activity seems in some degree to be increased in respect to the normal plasma.

Other researches are being carried out with plasma of fowl affected by erythroblastosis brought, by means of lactic acid or galacturonic acid, to the same *p*H, so as to ascertain whether in reality the elimination of an inactive substance from the leukæmic plasma and its successive activation is, as would seem from purely preliminary observations, the consequence of an elective action on the part of the ascorbic acid itself.

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Dec. 22.

[1] Murphy, J., Sturm, E., Claude, A., and Helmer, O., *J. Exp. Med.*, **56**, 91 (1932).
[2] Claude, A., *J. Exp. Med.*, **61**, 27 (1935).

Role of Manganese in the Biological Synthesis of Ascorbic Acid

SPECULATION on a possible explanation of the difference in ascorbic acid contents of different plants led me to the idea that this difference may be due to the activating influence on the synthesis of ascorbic acid by plants of some mineral or minerals which are not detectable by ordinary analytical methods. A close study of the paper by Boyd and De[1], who have made a spectrographic analysis of a number of vegetable and animal products, revealed the fact that the manganese lines are very prominent in those vegetable products and animal tissues which are generally rich in ascorbic acid content. This led me to the investigation of the role of manganese in the synthesis of ascorbic acid by plants and animals.

By germinating Bengal gram (*Cicer arietinum*) in distilled water and in dilute manganese sulphate solutions containing manganese equivalents of 1 in 10^6, 1 in 10^5 and 1 in 10^4 for six days under identical and sterile conditions, it has been found that the ascorbic content of gram germinated in dilute manganese solutions is higher than that of gram germinated in distilled water, the respective amounts synthesized being 63·7 mgm., 75·5 mgm., 86·6 mgm. and 84·7 mgm. per 100 gm. of the original dry grams. The ascorbic acid assay was made by a modified Tillmann method after reducing the dehydroascorbic acid in the extracts with hydrogen sulphide. The germination was better in 1 in 10^6 and 1 in 10^5 manganese solutions and more stunted in 1 in 10^4 manganese solution than in distilled water.

Fuller details of this and experiments on animals which are in progress will be published elsewhere.

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Dec. 23.

[1] Boyd, T. C., and De, N. K., *Ind. J. Med. Res.*, **21**, 109 (1933).

Absorption of Carotinoids from the Human Intestine

IT is generally supposed that, for human beings, carotene of vegetable origin is the principal source for vitamin A. If this is true, it is important to know the absorbability of leaf carotene. We have investigated this on two healthy male adults (namely, ourselves).

Test dose			Excretion in fæces			
	carotene	xanthophyll	carotene	%	xanthophyll	%
50 gm cooked spinach	1080γ	3675γ	1017γ	94	2478γ	67
50 gm. cooked spinach + 30 gm. lard	1660	4805	1573	95	3893	81
100 gm. cooked carrots	5700	370	5643	99	163	44
β-carotene dissolved in oil	1056		437	41		

For one to two weeks a diet was followed which was very poor in carotinoids (bread, rice, lard, meat, Marmite and 50 mgm. ascorbic acid daily). Then the excretion of carotinoids in the fæces was determined before and after intake of a test dose of vegetables containing a known quantity of carotinoids. The fæcal carotinoids were extracted with alcoholic potash, shaken out with peroxide-free ether and after evaporation of the ether dissolved in petroleum ether. The carotinoids were estimated colorimetrically with the Zeiss stepphotometer after chromatographic analysis according to Tswett with activated aluminium oxide (Brockmann).

While on this diet, 6–10γ carotene and 57γ xanthophyll per 20 gm. fæces were excreted. In the accompanying table the results are summarized of the determinations of the excretion above this level after intake of different test doses.

From these data it follows that nearly the total amount of vegetable carotene was excreted. Much better absorption took place when the carotene was dissolved in oil. Vegetable xanthophyll was absorbed to a greater extent than carotene.

Experimental details and a discussion of the facts from a dietetical point of view will appear elsewhere.

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Dec. 30.

Vascular Supply of the Pedicel and the Ovule in Species of Dilleniaceæ

THE vascular anatomy of the flower in many families of plants has been studied in recent years; but the family Dilleniaceæ has escaped attention. For this reason the floral anatomy of *Dillenia indica* Linn., *Wormia triquetra* Rottb. and *Wormia Burbidgei* Hook. has been investigated. The study has brought to light a number of interesting points, but the vascular supply of the pedicel and the ovule particularly has been found to be very unusual.

The pedicel in angiosperms normally shows in a transverse section either a complete ring of xylem and phloem or a ring of collateral vascular bundles surrounding a central pith. In these plants it has been found to show, through its greater length, several rings of vascular bundles. In *Wormia triquetra* there are five such rings arranged again in a ring-like fashion on the periphery of the pith (Fig. 1).

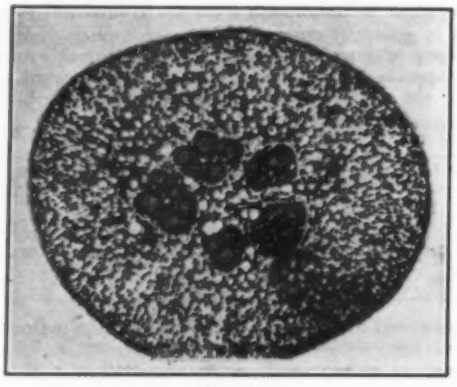

Fig. 1.
TRANSVERSE SECTION OF THE PEDICEL OF *Wormia triquetra*.

Each ring consists of 7–10 collateral vascular bundles with endarch protoxylem. In *Wormia Burbidgei* there are 8–10 rings; in *Dillenia indica* there are five such rings of vascular bundles. The pedicel thus in every case shows polystelic structure. Such a condition is not known in the flowers of any other angiosperms.

The ovule in angiosperms is generally supplied by a single vascular trace which travels up the raphe and ends at the chalaza. Rarely it may also penetrate the nucellus and reach the chalazal end of the embryo-sac. Exceptions to this condition are known only in some Amentiferous families, in which the ovular trace divides in the chalaza and sends branches to the integuments. In the above-mentioned Dilleniaceæ quite a new modification of the ovular vascular supply is seen. The ovular trace does not run unbranched up to the chalaza. It divides repeatedly during its course. About one third the way up, it bifurcates; the two branches divide again and then again. Ultimately all of them anastomose to form a plate of vascular tissue just at the base of the nucellus. The exact situation is shown in Fig. 2, which is a reconstructed diagram of the vascular supply of the ovule from a series of transverse and longitudinal microtome sections. Like the vascular supply of the pedicel, such a behaviour of the ovular trace has not been recorded for any other flowering plants.

Fig. 2.
DIAGRAM OF THE VASCULAR SUPPLY OF THE OVULE IN *Wormia triquetra*.

The material for the investigation has been supplied by Prof. A. C. Joshi, and I am much indebted to him for suggesting the investigation and for guidance during its progress.

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Nov. 29.

Genetic Control of a Morphogenetic Substance in *Drosophila melanogaster*?

STURTEVANT[1] has shown by the study of elimination mosaics involving an *X*-chromosome carrying the 'gene' Bar (reducing the number of facets in the eye of *Drosophila melanogaster*) that "the presence of tissue that is genetically 'not-bar' in some manner induces the formation of facets in tissue that is genetically bar and that would not normally have developed facets". The obvious conclusion was that these facts had to be interpreted "in terms of some influence that is intercellular in nature".

Transplantation experiments of Beadle and Ephrussi[2] have shown that Bar eyes, contrary to wild type eyes, do not produce the 'vermilion substance' required in the pigment formation of wild type. Unpublished results of Beadle and Ephrussi seem to indicate that several other genes influencing the size and the shape of the eye, such as Lobe or eyeless, partly or totally inhibit the production of the 'vermilion substance'. It was thought, therefore, that the vermilion substance and a *'facet-forming substance'*, suggested by Sturtevant's experiments, might be developmentally and, possibly, chemically related. Consequently, experiments were performed in which Bar larvæ have been supplied with *Calliphora* extracts rich in vermilion substance[3]. The flies were raised at a constant temperature ($25 \pm 0{\cdot}1°$ C.). Three different concentrations of nitrogenous extract were tested: 4, 8 and 16 per cent.

The results of the experiments are very clear, especially in the case of the highest concentration, where the eye size shows an obvious increase. Some facet counts have been made; the following table

summarizes the results of the counts made on males only:

	Observed facet numbers	Mean
Control	102, 97, 111	103
4 per cent extract	124, 134, 107, 120, 236	144
8 " "	294, 211, 175, 337, 205	244
16 " "	480, 486, 502, 4183, 89	455

(Among the treated females the observed maximum number of facets has been so far 382, as compared with the mean value of 85 in control females. Several heterozygous (*CIB/lz*) females have been observed: here the maximum facet number was 619 against 303 in the untreated control.)

It is clear that in these experiments the facet number has gradually increased up to about five times that of the control flies. There is considerable variation in the facet number within each experiment, which corresponds, in our opinion, to the variation of age of the larvæ at the time of treatment (in these experiments the age of the larvæ has been controlled only within 24 hours).

We interpret the above results as indicating that the extracts used contain a special morphogenetic (facet-forming) substance, the action of which is under genetic control.

The findings of Muller, Prokofjeva and Kossikow[4] and of Bridges[5], according to which the Bar effect is due to a small duplication, constitute a point of additional interest.

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Dec. 30.

[1] *J. Exp. Zool.*, **48**, 493 (1927).
[2] *Genetics*, **21**, 225 (1936).
[3] Khouvine, Y., and Ephrussi, B., *C.R. Soc. Biol.*, **124**, 885 (1937).
[4] *C.R. Acad. Sci. U.S.S.R.*, n.s., **1**, 87 (1936).
[5] *Science*, **83**, 210 (1936).

New Method for the Storage of Nematode Larvæ

THE following method of storing the infective larvæ of parasitic nematodes has been used at this Laboratory during the past twelve months and has proved to be very satisfactory. It has several advantages over the old method of storing in shallow water or in the fæces culture medium; it is clean and convenient, it requires a minimum of special apparatus, it lends itself admirably to proper indexing, it makes a tremendous saving in storage space and is very favourable to the longevity of the larvæ.

After having been drawn off from the Baermann's separation apparatus, the infective larvæ which are intended for storage are flooded, in a small amount of water, on to one or more 9 cm. wide filter papers (Whatman No. 42) standing on several thicknesses of blotting paper. As soon as the excess water has soaked into the blotting paper, the wet filter papers are taken up and placed on a second pad of several thicknesses of blotting paper, where they are allowed to remain for from fifteen to twenty minutes, until all of the wetness has soaked away. Controlled observations have shown that the optimum point for the most successful storage of the larvæ lies somewhere between the time of the disappearance of the shining wetness, and the first signs of cockling of the filter paper, due to dryness at the edges. This point is reached in between fifteen and twenty minutes after the wet filter paper has been placed on the second pad of dry blotting paper, the required time varying with the temperature and dryness of the atmosphere of the laboratory.

The moist filter papers (with particulars of the larvæ written on the back) are now placed face to face in a 9 cm. wide petri dish, a piece of adhesive tape is fastened round the dish, between the lid and the bottom, to prevent evaporation, and the whole is put away in a cool room at 36–40° F.

When larvæ are afterwards required for any purpose, one or more filter papers may be taken out of the petri dish or, if only few larvæ are wanted, part of a filter paper may be cut off with a pair of scissors; the paper is then placed, larva-side downwards, in a small amount of water in a petri dish or watch glass, when the larvæ quickly leave the paper and sink to the bottom of the vessel clean, and completely free from the debris that usually comes through the Baermann's apparatus along with the larvæ.

The method is also suitable for the transit of larvæ through the post, when the moist filter papers carrying the infective larvæ may be rolled up and placed in a test tube which is plugged with a tightly-fitting rubber stopper or treated in any other way which will prevent the evaporation of moisture from the filter paper.

The success of this method presumably depends upon the immobilization of the larvæ (through lack of actual wetness) and the provision which it makes for free contact with air in a water-saturated atmosphere. Examination of test cultures of trichostrongyloid larvæ stored in this way more than twelve months ago, show that 91 per cent of the larvæ are still alive and active. But apart from the convenience and efficiency of the method, the saving of storage space is enormous; it is possible to store some five hundred cultures of larvæ in the eleven petri dishes held by an ordinary copper petri-dish container, which only takes up some 9 square inches of shelf room, whereas by the old fæces culture-medium storage previously used here that number of cultures would take up no less than 31 square feet, unless placed specially in petri dishes in the copper containers above-mentioned, in which case it would take up more than 3 square feet.

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Jan. 7.

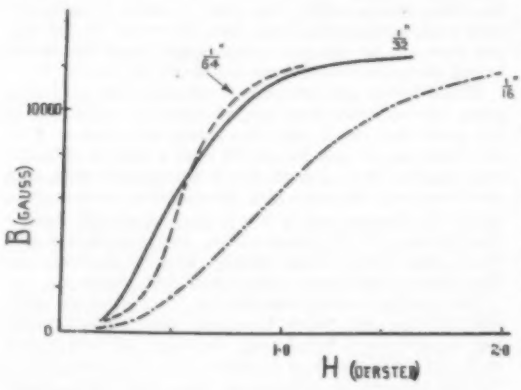
Magnetic Quality of Iron Wire as Influenced by the Diameter

IN a previous note[1] test data were given which showed how the permeability of nickel wire could be notably increased by surface treatment.

In the accompanying graph are given the magnetization curves for Armco iron wires of diameters 1/64 in., 1/32 in., and 1/16 in., respectively. The curves were obtained after each wire had been heated to 1200° C. in a stream of hydrogen until the permeability had reached a maximum value. From these and other test data it is inferred that:

(i) There is one diameter for which the permeability has the highest value, and the permeability falls off rapidly as the diameter is increased or

decreased from this critical value. The critical diameter for Armco wire is about 1/50 in., in which case the permeability is about 15,000. For a wire of 1/100 in. diameter the permeability is about 12,000 and for a wire of 1/8 in. diameter it is only about 4,000.



(ii) There is a surface layer of the wire which is magnetically harder than the core, and this surface layer has a dominant influence on the magnetic quality of wires of small diameter.

(iii) By coating the wire with suitable material and afterwards heat treating, the magnetic quality may be controlled over a wide range. On one hand, the permeability may be increased and the coercive force diminished, and on the other hand, the permeability may be decreased and the coercive force increased. For example, it has already been shown that when nickel wire has been copper plated and then heat treated, the permeability is notably increased.

Similar tests have shown that there is also for nickel wire a critical diameter which gives maximum permeability.

Full details of these investigations are now in course of preparation for publication elsewhere.

T. F. WALL.

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Dec. 11.

[1] NATURE, **139**, 928 (May 29, 1937); also, *Engineer*, August 13, 1937.

Nomenclature of the Seasons

IN a recent letter to NATURE[1], Dr. John R. Baker proposes a new nomenclature of the seasons. The eight new names formed by him (boredune, borepheuge, notodune, notopheuge; homodune, homopheuge, heterodune, heteropheuge) are to make good the lack of denominations for periods longer than a month and independent of the geographical situation of the place where the speaker is living or of which he is speaking. I believe, however, that the introduction of eight new scientific terms of Greek extraction is quite unnecessary for this purpose.

Dr. Baker says that a statement like "in south-west Ceylon winter is the hottest season" is absurd—which it is obviously *not*, for the speaker is, of course, thinking of the winter to which he is accustomed, that is of the winter of the temperate zone of the northern hemisphere, or of the months December–February. The sentence quoted above may be a little surprising for the first moment, but certainly no more so, and no more absurd than expressions such as: 'At the Cape of Good Hope January is the hottest month', or 'In the temperate regions of the southern hemisphere summer comprises the months December to February'. Certainly nobody would object to statements of this kind, and it seems, therefore, that a mental abstraction which is easy enough in some cases is considerably more difficult in other cases, though I cannot well see why this should be so. There were no such difficulties for the first European settlers in the tropics and in the southern hemisphere. They called the hot or dry season 'summer' and the cold or wet season 'winter' without any regard to the seasons at home, and in many instances even without regard to the temperature at the place where they were living: in several regions of tropical America the year is divided into the four seasons of *verano* ('summer': long dry season), *invierno* ('winter': long wet season), *veranillo* ('little summer': short dry season), and *invernillo* ('little winter': short wet season), in spite of the fact that the temperature is highest during the rains, thus during the local 'winter'.

Any difficulty in the denomination of the seasons can be overcome by simply putting 'northern' (or 'north') and 'southern' (or 'south'), respectively, before the ordinary names of seasons every time when a misunderstanding may be anticipated. This is much simpler than burdening the language by a number of new scientific terms and will be understood also by persons who have no knowledge of Greek. It also does not seem very practical to use, like Dr. Baker, the astronomical seasons: for meteorological and biological purposes as well as in everyday life, the meteorological seasons are to be preferred. We have thus: northern winter or southern summer: December–February; northern spring or southern autumn: March–May; northern summer or southern winter: June–August; northern autumn or southern spring: September–November.

A few examples may be given. If a man living in Europe says that he was in London last summer, or a man living in South Africa says that he was in Cape Town last summer, this is quite clear, and there is no need of adding 'northern' or 'southern'. If a man living in Europe says that he spent last summer in Cape Town, this might cause misunderstandings, and it would be advisable to state whether the northern or southern summer is spoken of. There is no possibility of misunderstandings in statements like the following ones: 'I spent the summer of 1937 in London', or 'I spent the summer of 1936–37 in Cape Town', or 'In south-western Ceylon the north winter is the hottest season', or 'The migratory bird *X* spends the northern summer in Europe and the northern winter in South Africa', or 'The bird *Y* breeds in England as well as in New Zealand during the (local) summer months', or 'The bird *Z* breeds in England as well as in New Zealand during the northern spring', or 'In certain regions of tropical America the northern summer is the wettest and hottest season, though locally called winter'.

CARL HANNS POLLOG.

In den Ziegelhöfen 1,
Basle.
Dec. 27.

[1] NATURE, **140**, 990, 1937.

Codeine in Indian Opium

AN anomaly has crept into my article on "Chemistry of Indian Opium" published in NATURE of July 17, 1937 (140, 92–93).

On p. 92 (col. 1), the figure for the codeine content of Indian opium is correctly given as 1–2 per cent. On the same page (col. 2), at the end of the first paragraph, the codeine content of opium is shown as 2–4 per cent. This latter figure was taken from a departmental report rather difficult of access, and is the figure given by Prof. Dunston. The reference was given in the original article, but was unfortunately eliminated in the process of compression.

In his "A.B.C. of Narcotic Drugs", O. Anselmino also gives this figure for codeine in opium in the words: "Said to be 2 to 4% at Jeypore". It is not stated upon what analytical basis these figures are quoted, but it should be made clear that the usual codeine content of Indian Excise opium is between 1 and 2 per cent.

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Dec. 20.

Points from Foregoing Letters

FURTHER evidence for nuclear transformation by the capture of a *K*-electron from the extra-nuclear structure is provided by Wilson-cloud photographs, submitted by Dr. E. J. Williams and E. Pickup, of the photo-electrons produced by the *K*-characteristic radiation, the emission of which follows the removal of the *K*-electron. The striking feature is that, for the active nucleus concerned in these experiments, the capture of a *K*-electron appears to be at least 1000 times more probable than the emission of a positive electron, a process which would lead to the same final nucleus.

Auroral spectra obtained by Prof. L. Vegard show that the relative intensity of the red line 6300 A. increases in passing to the upper part of the aurora (type *A*), while the relative intensity of the green line 5577 is greater in the lower auroral region. Prof. Vegard suggests that the enhancement of the red at the higher altitude may be due to oxygen atoms excited to the $^1D_2$ state through collisions between metastable nitrogen molecules and ozone molecules, produced by the short-wave radiation from the sun. Type *B* of red auroras have a red colour along the lower border due to an increase in the intensity of the first positive group of red lines, in the infrequent cases when the aurora reaches very low altitude.

In connexion with the hypothesis concerning the origin of the zodiacal light, Sir Joseph Larmor directs attention to an error for which he was responsible in reprinting Poynting's Collected Papers, which resulted in doubling the value of the suction of fine orbital dust into the sun. Sir Joseph envisages a nebula-like thick disk around the sun, remains of the original whirling solar nebula, still existing beyond the earth's orbit. This nebula may be considered of the type of the rings of Saturn, only enormously less closely packed. Its particles, as shown by the fact that the zodiacal light shows no scattering effect, must be larger than the wave-length of light.

Dr. A. Mercier states that if one tries to define a model of the primitive earth as a polytropic gas sphere, the conditions in its interior are found to be such that metallic vapours, particularly iron, must condense in a thick outer layer, from which the iron core usually postulated is produced.

Lieut.-Colonel L. M. Davies reports the discovery by A. G. Davis, recently confirmed by himself, of characteristic Upper Ranikot (Palæocene) fossils in beds on the western frontier of Persia. This is much the most western location of true Ranikot beds yet to have been recorded.

Further evidence concerning the probable structure of corticosterone (an active crystalline compound from the adrenal gland) is reported by M. Steiger and Prof. T. Reichstein, who find that corticosterone can be chemically transformed into the hydrocarbon allopregnane. The presence of a steroid structure is supported by the new data.

By adding ascorbic acid to the blood plasma, plus sodium oxalate, of a fowl affected by erythroblastosis (a disease characterized by the presence in the bone marrow of large numbers of colourless nucleated cells thought to be rudimentary red blood corpuscles) Dr. E. Morelli and Dr. A. Vercellone find that an inactive material is precipitated while the clear fluid becomes more active than before in producing the disease in other fowl. This result differs from that obtained by Claude and co-workers; in a somewhat analogous case, they found that the activity of the plasma in the case of fowls suffering from Rous sarcoma, the active principle was carried down by the precipitate upon acidifying the liquid.

By germinating Bengal gram in distilled water and in solutions with manganese equivalents of 1 in 10^6, 1 in 10^5 and 1 in 10^4, M. N. Rudra finds that the amounts of ascorbic acid synthesized in the latter solutions are higher than those produced in distilled water.

An experiment indicating that the carotene and xanthophyll in cooked spinach and carrots is almost entirely excreted in the fæces, is described by M. van Eekelen and W. Pannevis. Better assimilation takes place when the carotene and xanthophyll are dissolved in oil.

The study by K. C. Misra of the floral anatomy of *Wormia triquetra*, *W. Burbidgei* and *Dillenia indica*, three members of the Dilleniaceæ, has brought to light two very unusual features. First, the flower stalk contains several conducting strands, and secondly, the ovular trace branches repeatedly within the ovule.

Boris Ephrussi, Yvonne Khouvine and Simon Chevais find that *Calliphora* extracts considerably increase the number of facets in the eye of the Bar mutant of *Drosophila melanogaster*. They think that the extract contains a morphogenetic (facet-forming) substance under genetic control.

From tests on Armco iron wire, Dr. T. F. Wall infers that there is one diameter for which the permeability of the wire is a maximum and that the permeability rapidly falls off as the diameter is increased or decreased from this critical value; also that there is a surface layer of the wire which is magnetically harder than the core; and that by coating the wire with suitable material followed by heat treatment, the magnetic quality may be controlled over a wide range.

Research Items

Microliths from the Central Provinces, India

THE excavation of a rock-shelter, Dorothy Deep Shelter No. 1, west-north-west of Pachmari in the Mahadeo Hills, Central Provinces, India, by Dr. G. R. Hunter has brought to light an extensive series of microlithic quartz implements. An important feature is that the finds are stratified. In interim and final reports (*Nagpur Univ. J.*, 1, 1935; 2, 1936), the excavation of the shelter, which began in 1932 and was continued in 1934 and 1935, is described in detail. Two periods of occupation were distinguished: one of a later people using pottery, and an earlier civilization with quartz implements of characteristic Tardenoisian geometric form, without pottery or any trace of metal. The two strata of occupation were not separated by a sterile layer. This might have been expected from the fact that the character of the shelter was not such as would lead to the accumulation of deposits, except as the result of occupation. There is, in fact, an overlap of the two stratifications owing to the disturbance of the surface of the lower level during the later occupation. A human skeleton was found in the lower deposits, which was evidently not a burial by the later inhabitants. Unfortunately the remains were not sufficiently well preserved to admit of any conclusions as to the racial characters of the early inhabitants. As the find of worked or partially worked implements is roughly proportionate to the number of flakes, it seems probable that the shelter was a mesolithic factory. Quartz pebbles are abundant in the neighbourhood. The greatest depth at which pottery belonging to the later culture was found was twenty inches. No evidence was found of habitation earlier than mesolithic. As regards the evidence of stratification, there appears to be a true sequence of development in the microliths, but this still has to be worked out in detail. It should provide important evidence for the chronology of Indian microliths and possibly for those of other parts of the world.

Holy Days among Serbian Gypsies

DR. ALEXANDER PETROVIČ continues his investigations among the Serbian gypsies with an examination (*J. Gypsy Lore Soc.*, Ser. 3, 17, 1) of the institution of the Slava, which they have adopted from the Serbs, but with modifications due to their own ideas and needs, as well as to misunderstanding of the true character of this institution. The Slava is a custom essentially Serbian, and found among no other Slavic nation. It is supposed that when the Serbs adopted the Christian religion, each individual or group chose a Christian saint to act as the protector of the house and family, and to fill the void created by abandoning the family or tribal spirit associated with ancestor worship. To the Slava saint, his domestic protector, the Serb appeals when he fears calamity; and the Slava is celebrated as the feast of this patron saint. Some Serbian families celebrate a 'Preslava' during the summer. Both Slavas are inherited in the male line. The Slava is celebrated solemnly and as richly as possible, a great number of guests being invited. The gypsies, while adopting the Slava, failed to understand the difference between it and the holy days of the Church, and came to the conclusion that every Christian feast, including Christmas, Easter, etc., might be turned into a Slava. Some recognize a slight difference, making a 'kola' (a wheat flour cake) which is carried into the church on holy days. Others make a kola on all occasions. Generally the gypsy adopts a new Slava only in case of some misfortune, usually illness, when the new saint, to whom an obligation is incurred, is chosen by means of a ceremony in which the patient chooses one of three candles each dedicated to a saint. He prays to the chosen saint, and if he recovers, honours him with a Slava, which may be kept throughout the remainder of the patient's life. This Slava is not observed after his death by his children, except possibly by the offer of a candle. An individual may observe more than one Slava and in one instance the devotee observes five.

North American Collembola

BULLETIN 168 of the United States National Museum (1937) consists of a monograph on North American Collembola of the family Isotomidæ, by the late Dr. J. W. Folsom. All the known nearctic species of Isotomidæ have been considered in this monograph, and of the 66 species and 16 varieties dealt with, 28 species and 2 varieties are described as new. Not only has the author examined all the type specimens of the species of Isotomidæ described from North America, but he has also compared most of these with palæarctic specimens. Of the nearctic forms, 21 species and 9 varieties are found to be also palæarctic in distribution. Isotomidæ are generally regarded as having originated from forms resembling *Achorutes*, and in the species of *Guthriella* (described in this work) a better link has been found, between the Isotomidæ and Achorutidæ, than was hitherto known. Dr. Folsom's monograph, which is illustrated by 460 figures, is one of the most exhaustive studies of any group of Collembola yet published.

Decapod Larvæ from Madras

MR. M. KRISHNA MENON describes a number of planktonic larvæ in his recent paper "Decapod Larvæ from the Madras Plankton" (*Bull.* Madras Government Museum. New Series. Natural History Section, 3, No. 5, 1937). As he obtained several post-larval stages from the later larval stages, certain of his species are identifiable; in other cases he only gives the genus and even this is often queried, although good series of larvæ were available and their characters noted in great detail. As so little is known of the life-histories of Indian decapods, these notes are valuable and contain much that is new. Specially interesting is the fact that the author finds 12 pairs of gills in the fourth larval stage of *Albunea symnista* and 13 in the fifth larval stage, the adult only having 10 pairs. The megalopa of *Ethusa investigatoris* from the last larva resembles the adult very closely, and it was found that even at this early stage it covers its body with anything that is handy. It is hoped that Mr. Menon will continue these studies of the life-histories of Indian decapods, which are for the most part practically unknown.

Antarctic Crinoids

THREE species of crinoids are described by D. Dilwyn John, all obtained at four points not far removed from one another to the west of Graham Land (Expédition antarctique Belge. Résultats du Voyage de la Belgica en 1897–99. Rapports Scientifiques publiés au frais du Gouvernment belge, sous la direction de la Commission de la Belgica. Zoology. Crinoidea. 1937). The collection, as the author points out, is of historical interest as being the first from the south of the Antarctic Circle and near the coasts of the continent, and it is important in including the only known specimens of the stalked crinoid *Ptilocrinus antarcticus* (here redescribed). The two other crinoids collected are the common Antarctic species *Promachocrinus kerguelensis* and *Anthometra adriani*. More than a hundred specimens of the former have been taken in the recent "Discovery" Investigations in the Falkland Section of the Antarctic, from the south of which the present material comes. Notes on these are shortly to be published in the Discovery Reports confirming A. H. Clark's opinion that *Promachocrinus vanhöffeni* and *P. joubini* are synonyms of *P. kerguelensis*, which is found to vary widely.

Mycologically Produced Chemicals

AN interesting paper by Mr. R. P. Cook on "Moulds and the Chemical Industry" appears in the *Scientific Worker* of November (**9**, No. 8, pp. 203–206). It describes the production of citric acid by fermentation of sugar in shallow receptacles. A felt of *Aspergillus niger* is grown therein, and is potent to ferment four or five refills of sugary liquid run successively beneath it. Gluconic acid, ink and oxalic acid can be produced by similar means. Ink and oxalic acid are made by fermentation with species of *Aspergillus*, whilst gluconic acid requires the ministrations of a *Penicillium* mould. Alcohol may be formed from starch directly by many species of *Mucor* and *Aspergillus*, which first effect the hydrolysis of starch into sugar, and later its subsequent fermentation to alcohol. The paper is of wide general interest, but many of the processes described retain their detail within closely guarded commercial secrets.

Spiral Hyphæ of Dermatophyte Fungi

THE fungi which attack mammalian skin have provided many problems for the mycologist, and the intensive study which they have evoked helps to elucidate more general questions. Messrs. A. M. Davidson and P. H. Gregory have investigated the occurrence of spiral hyphæ in five species of the genus *Trichophyton* (*Trans. Brit. Mycol. Soc.*, **21**, Pts. 1 and 2, 98, Oct. 1937). These structures are believed to be organs of attachment which play a part in the infection of animal hosts from saprophytic sources. They are sticky, and when they adhere to an object, can break away from the mycelium. A large amount of inoculum would thus be transferred to the new host.

Nyasa-Shire Rift Valley

THE rift zone fractures in eastern Africa have been regarded as of late Tertiary age although certain associated volcanic rocks in the Tanganyika area and the Lower Zambezi date from the Cretaceous period. The Nyasa-Shire rift, forming part of this rift zone, has been generally regarded as due to the uplift and fracturing of a Miocene peneplain, but recently discovered Cretaceous beds within the northern Nyasa rift introduce a new factor. In the *Geographical Journal* of January, Mr. F. Dixey discusses the history of the Nyasa-Shire rift in the light of the evidence now available, including the relict uplands such as Nyika, Vipya and Zomba of 6,000–7,000 feet which surmount the Miocene peneplain. These are remnants of a great late Jurassic or early Cretaceous peneplain, or even of greater antiquity. Mr. Dixey contends that the instability which gave rise to the Nyasa-Shire rift and probably the Rukwa and Tanganyika rifts can be traced back to the early Cretaceous period with renewed movement in late Tertiary and post-Tertiary times.

Meteorological Depressions

GEOPHYSICAL MEMOIR No. 72 of the Meteorological Office, Air Ministry, is a discussion by A. H. R. Goldie of the structure of certain depressions that have passed across or near the British Isles in recent years. As the title of the memoir, "Kinematical Features of Depressions", suggests, it is a study primarily of the nature of the air motion in these depressions, and has been carried out in order to discover the type of vortex to which such storms approximate, with the view of arriving at an explanation of their development and life-histories. The greatest difficulty in studies of this kind is to derive from available wind data a general picture of the air movement such as could be obtained from a close network of well-exposed anemographs and pilot balloon stations, were such available. The author does his best to surmount this difficulty, with some measure of success as regards surface movement. He finds that except in an area around the barometric minimum, the average surface air movement is in accordance with that of a simple vortex (speed varying inversely as the distance from the centre); that in the part of the central area occupied by polar air the wind is sometimes proportional to distance from the centre, with some evidence that this area becomes larger with increasing age of the depression. Detailed analysis of this area showed a cell-like structure with convergence of both cold and warm air below 2 km. towards the main front through the centre of the depression, and upward motion above. The conclusion is reached that the energy for a depression is derived mainly from the high speed of the tropical winds, particularly in the higher levels, that is, from the planetary circulation, and that the vortex is started by the warming and humidifying of the polar air near a warm front. The results support modern Norwegian theory in a general way, although the typical structure of depressions seems to be arrived at through the circular and converging movement which is impressed upon the edges of the polar air mass.

Black Phosphorus

IT is nearly twenty-five years since Bridgman showed that white phosphorus was irreversibly transformed to a black modification at pressures of the order of 12,000 atmospheres and temperatures of about 200° C. He noted that for the first ten to fifteen minutes the transformation proceeded very slowly, and afterwards took place with almost explosive characteristics. A reinvestigation of this transformation in the same laboratory by R. B. Jacobs

has just been published (*J. Chem. Phys.*, **5**, 945; 1937). White phosphorus has been heated at approximately 13,000 atmospheres to about 205° C. for six different periods, all less than fifteen minutes and varying from each other by two-minute intervals. Then the pressure was reduced to half its highest value in order to retain the phosphorus in the solid state, and, on washing with carbon disulphide, a carbon-like powder was obtained in amounts bearing a close correlation to the times of heating. Visually this powder differed from the usual black phosphorus. Its density was 2·25 compared with 2·69. Whereas the usual black phosphorus gives distinct X-ray diffraction lines corresponding with an orthorhombic type of crystal structure, the 'new' black phosphorus gave no diffraction lines, and therefore it is either amorphous or microcrystalline. Measurements of the differences in the total heats between the various forms of phosphorus were obtained from the heats of reaction of the different modifications with bromine. These data indicated that the new black phosphorus is amorphous and a separate polymorphic modification. It has also been shown that the stable form of phosphorus below 560° C. is the crystalline black modification, and data illustrating the progression of stability of the different forms of phosphorus are given. Prolonged heating of amorphous black phosphorus at about 125° C. yields a brilliant violet modification of red phosphorus.

Examination of Colliery Ropes

FOR a number of years, the Wire Ropes Research Committee of the Safety in Mines Research Board has been conducting investigations into the deterioration and failure of colliery winding and haulage ropes, and has, from time to time, published accounts of these investigations. Colliery ropes are highly stressed and relatively complicated pieces of machinery liable to accidental damage and gradual deterioration which may gravely affect their strength, and the consequences of a failure, when men's lives depend on them, may be most serious. The law requires that each rope must be subject to two distinct forms of examination—a daily examination to ensure that it remains intact and is free from gross faults—a special examination carried out at least once every month when the condition of the rope is closely inspected and the progress of any deterioration is particularly noted. The former provides for cursory examination of the whole rope; the latter provides for detailed inspection at a number of places spaced out along its length. Out of 57 winding ropes which broke in service as a result of gradual deterioration it is stated that only 11 had been reported as showing signs of weakening. On investigation, the remaining 46 were found to exhibit such signs of deterioration as should have been noted by a vigilant examiner. For the information and use of those persons who are directly responsible for the examination of ropes, the Board has now issued a booklet entitled "The Examination of Colliery Ropes in Service" (London: H.M.S.O). It can be conveniently carried in the pocket, and sets out briefly the types of deterioration met with due to wear of different kinds, fatigue and corrosion, explaining their causes and how they may be recognized. The parts of the rope which should be examined with particular care, the methods of measurement and of examination and the limits of deterioration allowable are all set out clearly and concisely.

Refractive Powers

DURING the last thirty or forty years, the older definitions of the refractive power of a transparent substance, $\frac{\mu - 1}{\rho}$ of Gladstone and Dale, and $\frac{\mu^2 - 1}{\rho}$ of Newton, Selmeyer and Drude have been replaced by the $\frac{\mu^2 - 1}{\mu^2 + 2} \cdot \frac{1}{\rho}$ of Lorentz and Lorenz, where in each case μ is the refractive index for a definite wave-length and ρ the density. In the November and December issues of the *Journal of the Franklin Institute*, S. S. Kurtz and A. L. Ward make use of the available data for the refractive indices, dielectric constants and densities of liquid hydrocarbons over ranges of temperature often exceeding 100° C. and of pressure up to 12,000 atmospheres to test the relative values of the three definitions with regard both to light and to electricity, where the dielectric constant k replaces μ^2. Their conclusion is that the Lorentz-Lorenz expression should not be used except for rough approximations, that the Newton-Selmeyer-Drude should be used for the correlation of dispersion data for hydrocarbons, and that the form $\frac{\mu^2 - 1}{\mu^2 + 0{\cdot}4} \cdot \frac{1}{\rho}$ suggested by Eykman in 1919 should be used for the effects of temperature and pressure on both the refractive index and the dielectric constant.

Objective Prism Observations of Nova Lacertæ (1936)

D. T. Edwards and D. R. Barber have recently issued a paper with this title (*Mon. Not. Roy. Astro. Soc.*, **98**, 1, Nov. 1937), in which they give an account of the spectrum of this nova up to September 3, 1936. The instrument used at the Norman Lockyer Observatory was the 12-in. McClean telescope with a 20° prism, and the plates were Barnet "Super Press". The first photograph showed the typical α Cygni absorption spectrum, and this was followed by different stages of mixed absorption and emission, ending with the purely emission spectrum of nebular type. Three tables are given in which are indicated the more prominent absorption and emission lines, in addition to notes regarding their characteristics, widths and dates of appearance. Other tables show absorption-line and emission-line velocities. In the case of the latter, there is a systematic progression of velocity from positive to negative values, both for *H* and metallic lines, and this presents some puzzling features. It is suggested that the effect may be caused by masking of the red edges of the bands by absorption, or unmasking of the violet edges, and may not be a velocity effect. There is no doubt, however, about the progressive changes of the apparent displacement, and independent work by Bobrovnikov has recently confirmed these.

Isotopic Composition of Ordinary and Uranium-Lead

IN the paragraph appearing in NATURE of January 1 (p. 43) under the above heading, data reported as having been found for uranium-lead actually referred to ordinary lead, and vice versa. Thus, ordinary lead chloride was found to have the isotopic composition ^{204}Pb, 1·1$_8$, ^{206}Pb, 24·5$_8$, ^{207}Pb, 21·3$_8$, and ^{208}Pb, 52·9$_8$ per cent, giving 207·21 for the atomic weight of ordinary lead, in exact agreement with the value given in the International Table for 1937. Uranium-lead from Katanga curite was found to have the isotopic composition ^{206}Pb, 95·1, ^{207}Pb, 4·9 per cent, giving an atomic weight of 206·01 (O = 16).

Industrial Organic Chemistry

New Dyestuffs Laboratories of I.C.I., Ltd.

THE unprecedented character of the Dyestuffs (Import Regulation) Act of 1920 was both an expression by Parliament of its conviction that an active and flourishing dyestuffs industry is essential to the life of Great Britain, and a recognition of the technical difficulties of developing such an industry in face of the priceless experience and established position of foreign manufacturers. An exhaustive review at the end of the period of ten years, for which the measure was originally enacted, resulted in 1934 in its being made permanent.

The largest of the interests thus sheltered is now known as the Dyestuffs Group of Messrs. Imperial Chemical Industries, Ltd., and the opening on January 11 of its new research laboratories at Blackley afforded a further opportunity of considering the results of the legislative venture of 1920. The event was thus one of most unusual interest and importance, and attracted a large gathering representative of academic, administrative and manufacturing interests. The impressions gathered can scarcely have been other than of deep satisfaction.

Apart from all that has been done by the Dyestuffs Group in developing the manufacture of products already known, the early discoveries of the ionamine and duranol series of dyestuffs for acetate silk have latterly been supplemented by the solacet and phthalocyanine series. Further, much progress has been made in the direction of that broadening of activity into other closely allied branches of applied organic chemistry which marked the growth of the Continental industry. This must be regarded as a normal and essential feature of healthy development, and one which will confer on the industry as a whole increased stability. Indeed, it is this expansion to include, for example, modern detergents and textile assistants generally, plastics and rubber, medicinal chemicals, insecticides and fungicides, which has led to the provision of the new laboratories. The close interrelationships of these various fields of work were illustrated in the laboratories by an extremely well-organized series of exhibits representative of "Chapters in the Development of Industrial Organic Chemistry", and described in a well-illustrated presentation volume bearing that title, as well as by demonstrations to conducted parties of visitors.

Prior to this, in a happily informal speech which prefaced his performance of the opening ceremony, Mr. John Rogers had indicated the general outlook of the Dyestuffs Group and discussed the conditions which make for success in the type of research for which the new laboratories are designed. His faith in the productivity of abstract research work and the following up of unexpected results, his plea for a long-term policy and his appreciation of the co-operation both with users of his Company's products and with academic institutions, must all meet with the most cordial approval. It cannot be doubted that adherence to this attitude will provide a sure foundation for the future success and prosperity of the Dyestuffs Group and at the same time a most potent stimulus to the development of organic chemistry in Great Britain.

The laboratories have been designed by Mr. Serge Chermayeff and are intended to be only the first instalment of a larger programme. They take up the main block of a three-storey building, 400 ft. long, running north and south, and are entered from a corridor on each floor extending along the whole of the west side. Twenty-one separate laboratories of uniform type are thus provided, each with a partial subdivision, by shelving, into units which accommodate one chemist and offer him a measure of privacy. Fume cupboards glazed on both sides and provided with electrical, gas, steam, compressed air, vacuum, and water services back on to the corridors, where removable panels allow easy access to the service pipes. Continuous windows along the east and west sides of the building give a maximum of continual daylight in the laboratories with protection from too great heat of the sun. Ventilation is entirely by conditioned air, separate ducts, of course, being provided to carry away gases from the fume cupboards. The flooring of cork tile eliminates noise from the laboratories, whilst an air of cheerfulness is contributed by the use of different colours against a background of white.

It will thus be seen that to a thoroughly well-informed and progressive outlook there have now been added amenities which are first-rate from both the æsthetic and the immediately practical points of view. We tender to Messrs. Imperial Chemical Industries, Ltd., our sincere congratulations on these most favourable auspices and at the same time our best wishes for the future success of their enterprise.

J. K.

Wool Industries Research Association

THE Wool Industries Research Association's previous report, reviewed in NATURE of January 16, 1937, was an innovation issued for the information of the general public and firms outside the Association, in view of efforts then being made to secure a statutory levy. It is now reported that insufficient additional support has been forthcoming to warrant the introduction of an enabling Bill into Parliament, and this scheme has been dropped for the time being. It is, however, emphasized that nothing has been left undone to urge the claims of research, and the need for its financial support on a scale more adequate to the magnitude of the industry's interests. Meanwhile, generous response has been made by a number of individual firms for the purpose of meeting a serious and unexpected deficit in revenue, and the

Council has decided upon a substantial increase in the rate of subscription for the processing sections of the industry.

The report refers to two circumstances which may delay the development by a research association of new processes—'teething' troubles accompanying their translation to commercial production, and requiring a willingness on the part of the industry to experiment, and the smaller incentive to bear the brunt of these troubles when results must be common property than when the knowledge gained is the exclusive property of a private firm.

Comment is again mainly devoted to the development of the processes, referred to in last year's report, for rendering wool 'unshrinkable' and for producing a permanent bleach.

The loss of 'handle' on chlorination is largely restored by 'fixanol'—this suggestion emanated from the Textile Chemistry Research Department of the University of Leeds—and it is now reported that substances of this type, which unite with wool substance, form a chemical link between the fibre and rubber latex, and a patented process has been evolved for rubberizing yarns to give water-repellent, moth-proof, and wear-resistant properties, and make available low-twist yarns of good strength.

Stress is laid on the importance of accurate measurement of fibre diameter as a fundamental necessity "for any progress to be made in the understanding of the manufacturing performance of wool", and "for the farmer to have reliable numerical data on which to base his breeding policy".

It is maintained that the fear expressed in some quarters that measurement of fineness in wool tops may become a bugbear in commercial dealings, could only be realized if it were used as a measure of quality, with the rather ambiguous comment that the latter is "a development which it is within the hands of the Trade alone to prevent".

Statistical analysis has also been applied to the variability of woollen card slubbing with the view of reducing uneconomic margins of tolerance.

Other subjects referred to as having received attention are the examination of proposed alternatives to olive oil for combing, of new detergents for wool scouring, and of the effect of various dyeing processes on the spinning power and handle of wool. An increased demand on the part of members for the investigation of special problems is also reported.

Thus it is evident that the Association is energetically pursuing investigations on the technical and statistical sides, which may disarm any criticism of the restricted output of publications in scientific journals. Readers appreciating the functions of organized research in industry will, perhaps, feel more confident than the Director of Research that the non-participating section will diminish, but this will follow less from the reproof he administers than from a conviction borne of a fuller demonstration that it is missing benefits by standing aside.

Rothamsted Experimental Station

THE form of the Rothamsted Report* for 1936 differs from those of former years in that a number of investigations which have extended over a period of years have been selected for detailed discussion, thus summarizing the results up to date. This type of annual report has an undoubted advantage in presenting the results of agricultural research, where a number of variable factors, such as seasonal effect, enter, tending to give uneven progress towards final conclusions; the results of one year may not give a representative picture of the work in hand. Though the work at Rothamsted is mostly of a fundamental type, the practical needs of the farming industry are kept continually in mind, the research programme being under constant scrutiny so as to follow up immediately those results likely to have a practical bearing. With long-period research, such as that embracing some of the field experiments which have been in progress for half a century, the need for such a policy is apparent, and it probably explains much of Rothamsted's secret of interesting both the research worker and the farmer.

The results of the various investigations on grassland problems come at a time when pasture management is a subject of topical interest and, for that reason, occupy most of this note; it may be mentioned that the recent International Grassland Congress visited Rothamsted in order to examine the Park grass plots. The Land Fertility Scheme, again, lends interest to the trials on the effects of manures on the botanical composition and yield of pastures. Attention is directed to the difficulties of drawing correct conclusions on the variations in the proportions of individual species as the result of manuring, because a decrease in one species may not, for example, be due to the direct action of the fertilizer, but to its being suppressed by an increase in another. Thus, the well-known effect of sulphate of ammonia in causing a decrease in the proportion of legumes in a mixed sward that is not closely grazed is due to their suppression by the greater growth of grasses resulting from this manure. It is interesting to note that the effect of lime has been most marked on the liberally manured plots, the plots standing out even in winter. Again, liming helped the sward to stand extremes of climate, heavy frost and drought having killed the herbage on the unlimed plots treated with sulphate of ammonia and mineral manures, while the grass on the limed plots was not affected. In the experiments with phosphatic manures, it has been observed that, by analysing the herbage and getting the figures for the percentage recovery of added phosphate, it has become much easier to interpret the results of the trials than by merely observing yields of hay. This is the sort of information that should be kept in mind when the time arrives for assessing the success or otherwise of the Land Fertility Scheme.

The effect of the composition of the original seeds mixture sown when laying down a field to grass has been studied in a ley put down eight years previously. Research of this type has established the fact that, under most conditions, there is no particular advantage in sowing a large number of species, since,

* Rothamsted Experimental Station; Lawes Agricultural Trust. Report for 1936. Pp. 294. (Harpenden: Rothamsted Experimental Station, 1937.) 2s. 6d.

in a few years, these become reduced to a few, such as perennial ryegrass, wild white clover, etc.; exceptions to this sometimes come to light, such as when Percival observed that, in the Thames Valley, all the species of plants sown were still found after nineteen years. In the ley studied at Rothamsted, the ryegrass, cocksfoot, timothy, rough-stalked meadow grass and wild white clover formed the overwhelming bulk of the herbage after eight years. It is interesting to contrast some features of these results with those found by Alun Roberts at a number of centres in Wales, where the rainfall is higher, and where there is hard winter grazing by sheep. At Rothamsted, cocksfoot, and particularly timothy, survived much better than at the Welsh centres. Again, in the west, Italian ryegrass had completely disappeared at every centre in three years, while at Rothamsted this variety proved unexpectedly persistent, contributing largely after eight years; it must be assumed that this persistence was due to self-seeding. The Rothamsted experiments are important for large tracts in the drier parts of England, where economic conditions have forced many to put down land to grass.

The experiments on the composition of ryegrass are of particular interest in view of the position regarding the various methods of grass conservation. The high proportion of fructosan, which is soluble in cold water, found in spring grass when the panicle emerges, and the decrease in this substance on further maturity, indicates that research in this direction may throw important light on such questions as losses in conserving young and more mature grass by various methods, and the relative values at different times of the year of pasture grass having similar chemical composition when expressed by the conventional method.

Experiments on the relation of cultivation to crop yield have been in progress since 1926, these being concerned with a study of the effects of the standard operations, and with a comparison of standard methods with rotary cultivation. There is a considerable body of evidence from other countries that yields are not increased either by extra or deeper cultivation above a certain minimum well below what British farmers would accept, and eleven years experiments on heavy soil at Rothamsted and on light soil at Woburn tend to confirm this. Rotary cultivation, which produces a tilth in one operation, has given no harmful results when carried out on the same land year after year, provided that—for certain crops—it is done sufficiently deeply.

Other sections of the report, such as those dealing with the work of the Fermentation Department and of the Departments of Fungicides and Insecticides, and also of Entomology, are equally important because of the amount of valuable information contained in them.

Display and Reference Exhibits in Museums

By Samuel G. Gordon, Department of Mineralogy, Academy of Natural Sciences of Philadelphia

THE new mineral gallery of the Academy of Natural Sciences of Philadelphia contains seven sections devoted to educational exhibits, the William S. Vaux Collection, Pennsylvania minerals, the fluorescent minerals, meteorites, gem stones, and special exhibits (radioactivity, new accessions, loan collections, etc.)

Frameless cases, virtually glass envelopes (described in the *Museums Journal*, November 1936) were designed in which the plate-glass is supported by a minimum of metal. Such construction was found possible in large wall cases, table cases, floor cases and pedestals, with the result that visitors are less 'case-conscious'. The educational exhibits (What is Geology? What is a Mineral? What is a Crystal? The Interior of the Earth, etc.) are in wall cases lined with black suède-like paper which gives the incisiveness of a blackboard sketch. The labels, a tersely written *sequence*, are combined with the illustrative material (rigidly selected specimens, charts, maps, transparencies, models, instruments, etc.) in a *layout* in which lines, designs, colour, and other symbolic devices are used to develop a logical continuity. All other lines, arbitrary designs, meaningless colour, coarse textures, hardware, supporting accessories, ornamentation and distracting effects are avoided.

Less than 10 per cent of the minerals of the Academy collections are shown in the systematic series, about half in wall cases, and the rest in high table cases. Care was taken that each individual specimen, shown against black velveteen, was set up to the best advantage (four specimens took two hours apiece for this operation). Supporting means (mostly glass tripods) are unobtrusive. The green colour of glass shelves was found to be due to total reflection (within the plates) of the back edges; the colour was eliminated by painting the back edges black. Labels were printed on plastocele (cellulose acetate) with a lino-scribe, a device which uses printers' type and cuts. There is also an index with cross references to the minerals. Lighting (outside the cases) is concealed, and unobtrusive valances were used at strategic points in the wall cases to eliminate reflections.

The fluorescence exhibit (the first in America, following soon after that in the British Museum (Natural History)) is at the turning-point of the gallery. When reopened, it will be set in operation by the visitor passing a pair of photo-electric cells, and the automatic cycle (electric lights, ultra-violet lamps, darkness) will be synchronized with a four-minute record explanatory of the phenomena.

The focal point of the next section is another educational layout: "What are meteorites?" Elaborate series of cut gemstones, jades, birth-stones, ornamental stones are shown in the succeeding bay. The last section includes an exhibit of radioactivity, in which the story of its discovery precedes a demonstration using an ionization chamber connected with a circuit terminating in a neon lamp which flashes as gamma radiation enters the chamber.

Thus modern technical resources are being used to make exhibits educational and to stimulate interest in natural history. But what about the many specimens of which the rarity, obscure character, or specialized interest do not make it feasible to give them expensive display space? How are these to be made available to the serious student? What is to happen to the many specimens cluttering up museum cases when these are relegated to storage cabinets?

It is probable that the answer will be found in the development of reference museums. We have all admired the efficient organization of libraries, where staffs have been trained in the cataloguing and care of books, and their preservation in fire-resisting structures. The huge bulk of accumulated natural history specimens in many of the older museums presents a storage problem. With the gradual extinction of many species of wild life, the growing scarcity of others, and the increasing difficulties of collecting, it is essential that what we already have be assured permanent preservation and greater accessibility to students.

Such collections could be compactly stored in metal cabinets in vermin-proof, fire-resisting library-stack-like structures. Specially trained curators could receive, prepare, catalogue, place and care for the specimens received by the museum. The distribution of specimens to research workers in their own and to other institutions, and of loan collections of duplicates to schools, would be in their hands. No small part of their activity would be to bring out of the stack, for examination at close hand, any specimen desired by a serious student.

An experiment in this direction will soon be made by the Mineralogical Department of the Academy. Visitors will be advised that any specimens they desire to see, if not on exhibition, will be placed by a member of the staff in a special, well-lighted case for their examination.

The German North Atlantic Expedition*

HAVING almost completed their examination of the data brought home from the South Atlantic Ocean by the *Meteor* in 1925–27, German oceanographers have set out to make a thorough investigation of the North Atlantic, and as the result of a conference between the Commander-in-Chief of the Navy, the council of the Deutschen Wissenschaft and the director of the Institut für Meereskunde, the German North Atlantic Expedition has been organized.

The plan of the new expedition is to complete the network of modern oceanographical observations over the Atlantic Ocean, linking up the work of the *Meteor* in the south with her subsequent investigations in Iceland and Greenland waters, and with the work of the American *Marion* and *Atlantis* expeditions in the Davis Strait and the western North Atlantic. The area to be covered extends from 15° N. to 64° N. between the west coast of Europe and Africa and a line from the West Indies to Nova Scotia.

The main objects are the study of the physico-chemical structure of the sea, and meteorology. It is hoped that a large number of scientific and practical problems, many of them connected with the Gulf Stream, will be solved, and Prof. A. Defant, who is directing the work, is confident that information likely to be of material assistance in long-range weather forecasting will be obtained.

The *Meteor*, now re-engined as a motor-vessel with a cruising radius of 9,000 miles at an average speed of 12 knots, is to be used, and the Institut für Meereskunde, the Deutsche Seewarte, the Marine Observatories of Wilhelmshaven and Kiel, and the State Meteorological Department, are co-operating with the Navy. The whole project is not to be accomplished in one commission, but by a number of shorter voyages.

The first voyage, partly a trial cruise, and mainly an addition to the original programme, was started in February and completed in May of last year. The region from 10° N. to 28° N. between the African coast and 30° W. was examined; about seventy stations were worked at 60-mile intervals on six east-to-west lines, half of them falling between the African coast and the Canary and Cape Verde Islands. At each of the inshore stations hourly observations were made over a period of 60 hours, and one series of current observations over a period of 48 hours was made with the ship anchored in deep water. Six oceanographers, two meteorologists and two magneticians were carried, and the officers and crew numbered 121.

Only a very preliminary account of the results is available, but it is clear that much important information has been gained. The whole of the coastline of this part of Africa is marked by upwelling, and although the water comes to the surface from relatively shallow depths, the surface temperatures may be 5° or 6° C. colder than those farther offshore. The region also has a rich plankton population. The continuous hourly observations reveal changes of very short period, and show that the conditions in the thermocline at a depth of 25–60 metres respond very quickly to changes at the surface. The chemical work included determinations of silica, phosphate and nitrite.

A large number of observations were made on the upper-air currents, 209 balloons being followed by the new radio-ranging method, which seems much better adapted for work in an unsteady ship than the usual theodolite method. The nautical staff carried out an extensive programme of echo-sounding, and made researches into the reliability of modern instruments and methods of fixing positions at sea. Magnetic observations were made in the Canary and Cape Verde Islands.

During the three and a half months voyage, much was accomplished, and it is evident that the investigation of the greater part of the North Atlantic Ocean by similar methods will produce most important results.

G. E. R. D.

* "Bericht über den ersten Teil der Deutschen Nordatlantischen Expedition des Forschungs- und Vermessungsschiffes *Meteor*, Februar bis Mai, 1937", Von A. Defant. Sonderausgabe aus den *Sitzungsberichten der Preussischen Akademie der Wissenschaften, Phys.-math. Klasse*, **19** (1937).

Science News a Century Ago

Locomotives on the Liverpool and Manchester Railway

AT a meeting of the Institution of Civil Engineers on January 30, 1838, Edward Woods, the chief engineer of the Liverpool and Manchester Railway, read a paper containing an account of the alterations which had been found necessary in the first locomotives used on that line. These alterations, he said, consisted principally in strengthening every part of the engines, and the consequent increase in the weight was such that it became necessary to relay the whole of the line with stronger rails, and as a temporary provision to add a third pair of wheels behind the fire box. Woods then went on to refer to certain necessary conditions in the structure of locomotives, and the means adopted to obviate the rocking motion and the unsteadiness arising from lateral undulations. With respect to the objections urged against the use of six-wheeled carriages, he observed that the adhesion though less was sufficient, and that the additional weight did not exceed two hundredweight, or produce a diminution of traction amounting to more than one two-hundredth of the whole; and that the additional strain and friction on passing curves may be entirely obviated. He then discussed the distribution of the whole weight of the engines on the wheels, which weight on the average amounted to eleven and a half tons. Woods was twenty-four years of age when he read this paper. About fifty years later he served as president of the Institution.

Heat of the Earth

AT a meeting of the Geological Society on January 31, 1838, an extract from a letter addressed by Sir John Herschel to Lyell, dated Feldhausen, June 12, 1837, was read. It contained some additional observations relative to the writer's views respecting the increment of temperature which may be produced in some places within the crust of the earth, by the distribution of additional beds of sediment over the bottom of the ocean, and the consequent elevation of those tracts. In this letter, Sir John Herschel expressly alluded to Mr. Babbage's view on the subject given in a paper on the Temple of Serapis read in March 1834, but he stated that he was not aware of that gentleman having speculated on the same mutual reaction of the surface and the interior of the globe, until his attention was recently directed to the circumstance.

Ornithological Society

IN the report of the Council of the Ornithological Society read at a meeting held on February 2, 1838, it was stated that Mr. Blyth had been appointed assistant secretary and curator of the museum, the latter post being rendered necessary by the munificent loan of the Hon. W. T. Fiennes. It was announced that the collection of living birds had sustained little injury from the severity of the winter. Mr. Blyth then commenced a discourse on the geographical distribution of birds by enumerating first a variety of groups and species which are confined to particular regions; and secondly, others, and some of comparatively trivial value, which are diffused over the greater portion of the world. He illustrated the subject by adducing various phenomena of geology and botany; enumerated and explained some of the more interesting analogous adaptations of different types of form, geographically separated; surveyed theories of zoological provinces, particularly commenting on Dr. Richardson's, and directed particular attention to the fact that those North American birds which have no generic representative in Europe, and those European genera which have no species proper to America, are almost without exception, migratory.

Dr. Neil Arnott's Stoves

DR. NEIL ARNOTT, F.R.S., in 1838, published his work "On Warming and Ventilating: with Directions for Heating and Using the Thermometer Stove". The book was reviewed in the *Athenæum* of February 3, 1838. "Dr. Arnott", said the reviewer, "has already established his reputation as a practical benefactor to mankind, and now he has come before the public again with another application of philosophic principles to domestic use, which will add in no ordinary degree to the comforts of all, but most especially of the humbler classes. . . . The superiority of the apparatus consists in the power of so regulating the afflux of air to the fuel as to consume no more of the latter than is absolutely necessary to heat the apartment to the required degree. . . . During the winter Dr. Arnott kept his library at 60–63° F. with an expenditure of 6 lbs. of Welsh coal a day. . . . The stove is with us all important, and we have thought it our duty to bring it under the consideration of our readers. There is no mystery—no concealment in the matter. In this as in the water bed, Dr. Arnott has not even sought to derive pecuniary benefit from his labours and discoveries; instead of securing a fortune by patent privileges, he has with a noble liberality, worthy of national recognition, made the discovery public."

State of Medical Science in Spain

THE issue of the *Lancet* of February 3, 1838, contains a letter with this heading from William Lambton, late surgeon attached to the British Army Legion, illustrating the lack of respect shown to the medical profession in Spain in contrast with the high esteem in which it was held in France and England.

According to Lambton, when the British Legion went to Spain in 1835, it was notorious that the medical officers had the worst billets, and with but few exceptions received the most cavalier treatment from the Spaniards. "The surprise", continues Lambton, "which this want of respect created in my mind was entirely eradicated on perusal of the following advertisement, which appeared in a Madrid paper: 'Wanted a medical man who will undertake to attend a parish four leagues from Madrid: the salary is 4000 reals (about £40) a year, out of which he is to pay 375 reals for the maintenance of the poor. His keeping of a barber's shop, however, will prove no detriment to his capacity for the office, as it is understood that he will be allowed to make what he can by shaving. He must, however, be a chartered member of the Madrid faculty'. . . . Spanish surgeons", says Lambton, "are without exception the coolest operators I ever saw in my life, for when engaged in an operation in their own hospital they are generally to be seen with a pipe or cigar in their mouths, swearing at the cries of the patient or at any mishap which may occur during the operation. Nor are they by any means proud of their position, for they resign the knife to any professional bystander who is willing or anxious to operate."

University Events

CAMBRIDGE.—The Iron and Steel Industrial Research Council has approved of a grant being made by the Alloy Steels Research Committee (a Joint Committee of the Iron and Steel Institute and the British Iron and Steel Federation) at the rate of £500 a year from January 1 for research on corrosion fatigue under the direction of Dr. U. R. Evans. Although this grant is made for one year only, it is understood that there is every intention of renewing it for 1939. A former grant from the Iron and Steel Industrial Research Council in aid of Dr. Evans's research was made in 1936.

At Clare College, W. B. Reddaway, of King's College, has been elected into an official fellowship. He gained a first class in the Mathematics Tripos, Part 1, in 1932, and a first class in the Economics Tripos, Part 2, in 1934.

EDINBURGH.—At a graduation ceremony on December 17, the degree of D.Sc. was conferred on Kalipada Biswas, superintendent of the Royal Botanic Garden, Calcutta, for a thesis entitled "Studies on the Systematic Botany of India", and on Sanford Sterling Munro, for a thesis entitled "Studies on the Genetics and Physiology of Reproduction in the Fowl".

LEEDS.—Dr. Geoffrey Holmes has been appointed to a newly instituted honorary lectureship in medical hydrology.

Mr. Charles Ludwig has been appointed to a demonstratorship in physiology.

OXFORD.—The Herbert Spencer Lecture will be delivered on February 25, at 5 p.m., in the Examination Schools by Prof. Ernest Barker, Laura Spelman Rockefeller professor of political science in the University of Cambridge. The subject of Prof. Barker's lecture will be "Natural Law in the Political World".

Societies and Academies

London

The Royal Society, January 20.

D. KEILIN and E. F. HARTREE. Mechanism of the decomposition of hydrogen peroxide by catalase. A new explanation of the mechanism of the decomposition of H_2O_2 by catalase is proposed. According to this explanation the reaction is brought about by the successive reduction of the catalase iron by H_2O_2 and its reoxidation by molecular oxygen. This explanation is supported by experiments. The inhibitors of catalase can be separated into two groups, those like KCN, H_2S, C_2H_5OOH which inhibit the reduction of catalase iron by H_2O_2 and those like azide, hydroxylamine and hydrazine which inhibit the reoxidation of the reduced catalase by molecular oxygen (Keilin and Hartree, 1936). The decomposition of H_2O_2 by pure catalase preparations is not inhibited by CO in presence of even a very small concentration of oxygen, which shows that the reduced catalase has a much greater affinity for oxygen than for CO. Some catalase preparations have been obtained which show a more or less marked light-sensitive inhibition by CO. Pure catalase preparations become sensitive to CO in presence of a very small concentration of azide, cysteine or glutathione, substances which apparently inhibit the reoxidation of reduced catalase.

H. J. A. DARTNALL, C. F. GOODEVE and R. J. LYTHGOE: The effect of temperature on the photochemical bleaching of visual purple solutions. The theoretical considerations developed previously for the photochemical bleaching of a light-absorbing substance have been extended to include the case where the products absorb light. Twenty-five out of twenty-nine experiments with visual purple were found to be in accordance with the previous theory. In the remaining four, the decomposition of a coloured product, 'transient orange', proceeded at a rate comparable with the rate of bleaching of visual purple. The quantum efficiency of the bleaching process was found to be independent of temperature over the range 20° to 60° and of *p*H from 7 to 9·2. It is concluded that the quantum efficiency is equal to or not much less than unity, and that the molar extinction coefficient ($\lambda = 506m\mu$) is $1{\cdot}41 \times 10^4$.

J. W. HUGHES: The monaural threshold: effect of a subliminal contralateral stimulus. The change of threshold intensity in one ear when a note of fixed subliminal intensity is sounded in the other has been determined by direct experiment. The results of the investigation show that for two notes in unison, the total energy required in the two ears at the 'binaural threshold' is equal to the energy required in one ear at the monaural threshold, independently of the actual division of energy between the two ears.

Paris

Academy of Sciences, December 13 (*C.R.*, 205, 1189-1268).

MARIN MOLLIARD and ROBERT ECHEVIN: The secretion of the fly-catching Caryophyllaceæ. The Caryophyllaceæ present a series of secretions localized in the upper part of the plant, consisting essentially of a sugary material. The secretions vary slightly from one species to another.

DRAGOSLAV S. MITRINOVITCH: The differential equation of the geodesic lines of spiral surfaces.

GEORGES KUREPA: The hypothesis of the continuum and partially ordered ensembles.

STEFAN BERGMANN: A connexion between the theory of elliptical partial differentials and that of the functions of a complex variable.

CAIUS JACOB: The problem of Dirichlet in two dimensions.

JULIEN KRAVTCHENKO: The problems of conformal representation of Helmholtz: the study of a limiting case in the theory of the (ship's) wake in a perfect fluid.

LUCIEN HIBBERT: The surface of the moduli and automorphy of the polynomials and of integral functions.

J. KAMPÉ DE FÉRIET and A. MARTINOT-LAGARDE: The distribution between the mean motion and motion of agitation of the energy dissipated in the turbulent flow of an incompressible fluid.

ALEXANDRE FAVRE: Study of the Toussaint-Carafoli tunnel and of hydrodynamic movements in two dimensions.

HENRI MINEUR: The equilibrium of star clusters when the differential rotation is neglected.

HERVÉ FABRE: The absolute orbits of Gyldén.

TCHENG MAO-LIN: The spectrophotometric study of the minima of Algol. According to earlier work,

the minimum of Algol is produced later for the blue rays than for the red. This is not confirmed by the author, who concludes from his observations that for all radiations in the interval 3900–6500 A. the minimum of Algol is produced at the same time within 1 or 2 minutes.

CONSTANTIN SALCEANU: The measurement of the velocity of sound in liquids by a resonance method. A modification of Bungetzianu's method has been applied to measuring the velocity of sound in seventeen liquids and the results compared with those obtained by A. Cisman by a direct method.

ALBERT ZMACZYNSKI and ALBERT BONHOURE: The boiling point of water as a function of the pressure. Owing to the discovery of an error in the temperature coefficient of the bridge resistances of the platinum thermometers used in earlier work, the formula given (*C.R.*, **189**, 1069) is now corrected.

JACQUES VOROBEITCHIK: A new objective method of heterochrome photometry.

MAURICE PARODI: Study of the transmission of blende and of some halogen derivatives of copper and of cadmium in the extreme infra-red.

MICHAEL DUFFIEUX and JEAN BOLLOT: A method for the study of the hyperfine structure and the width of absorption lines.

RAYMOND RICARD, MARGUERITE GIVORD and FRANÇOISE GEORGE: The spark spectra of cæsium.

JACQUES SOLOMON: The disintegrations produced by electrons of very great energy.

PIERRE JACQUET: The electrolytic polishing of aluminium. The electrolytic method of polishing previously described can be applied with advantage to a soft metal such as aluminium.

G. AUSTERWEIL and A. FIEDLER: The preparation of a purified water comparable with distilled water by the exchange of ions.

MME. RAYMONDE DUVAL and CLÉMENT DUVAL: Differential electro-titration.

PAUL GOISSEDET and ROBERT DESPOIS: Some camphoric *N*-alkyldiamides.

GEORGES ZBYSZEWSKI: The discovery of new deposits of terrestrial vertebrates in the Neogene in the neighbourhood of Lisbon, Portugal.

MLLE. SUZETTE GILLET: The presence of the Pontian in the region of Salonika.

ALBERT ROUBAUX and MARC BERNATZKY: The effect of primary faults during the deposition of secondary strata in Lorraine.

LOUIS DUBERTRET: The marine Pliocene in the neighbourhood of Antioch (Syria).

CHARLES EMILE BRAZIER: Contribution to the study of the relations between the insolation and the components of the total radiation in the climate of Paris.

PAUL ROUGERIE: The study of the lunar effect on the earth currents recorded in the north-south line at the Observatory of Parc Saint-Maur.

PAUL BERTRAND: The successive and sudden appearance of different groups of vascular plants.

FERNAND OBATON: The variations of the quantities of water in the floral peduncle of *Papaver Rhoeas* in relation with its straightening in the course of flowering.

MLLE. MADELEINE FRIANT: The interpretation of the brain of the hippopotamus by the study of an embryonic stage.

MARC ROMIEU, MLLE. GABRIELLE LINAS and GEORGES JULLIEN: The morphological characters of the Purkinje plexus of the human heart.

BARUCH SAMUEL LEVIN and LEO OLITZKI: The diminution of the pathogenic action of some microbial strains cultivated in a medium containing lecithin.

ANDRÉ PAILLOT: A new type of pseudo fat-body observed in the larvæ of *Euxoa segetum*.

Rome

National Academy of the Lincei (*Atti*, **25**, 529–674; 1937).

F. SEVERI: Systems of equivalence of any species on one algebraic variety, as rational systems (1).

O. SCARPA: Possibility of the electrolytic working up of very impure copper and on the formation of cathodic tree-like growths in the industrial refinement of copper.

A. STELLA: A gabbro-diorite and kinzigite formation in the Alta Valtellina.

S. CHERUBINO: Application of holomorphous functions of matrices to systems of linear differential equations (1).

B. D'ORGEVAL: An extension of the principle of degeneracy to the theory of algebraic surfaces.

M. GHERMANESCU: Regarding a theorem of Mauro Picone.

F. GIACCARDI: One condition for which a periodic analytical function reduces to a trigonometric polynomial.

R. L. GOMES: A new demonstration of the equivalence of two systems of Dirac.

B. MANIÀ: A notable lemma for the problems of Mayer, and one of its applications.

L. TOSCANO: Secular equation with a circulant matrix.

G. COLONNETTI: Elastic equilibrium of systems in which non-elastic deformations also occur (3).

E. FROLA: Dynamic generalization of the theorem of Betti different from that of Lord Rayleigh.

G. LAMPARIELLO: Vortex rings which generalize the scheme of Bénard-Kármán for the hydraulic resistance.

O. ZANABONI: Evaluation of the maximum error which arises from the application of the principle of de Saint-Venant in an isotropic solid.

G. AGAMENNONE: Scientific results from a large mine explosion.

S. FRANCHETTI: Calculation of the penetration of electrons of some millions of volts (2).

G. RACAH: Isotropic tensors which show particular symmetries (2).

A. BARONI: Sulphides, selenides, and tellurides of thallium (1). Thallium selenides.

L. CAVALLARO: Absorption bands in polar substances at very high radio frequencies (3). Measurements with *n*-propyl and octyl alcohols.

W. CRUSA: Oxidation of α-oxyacids.

A. IANDELLI and E. BOTTI: Crystal structure of compounds of the rare earths with metalloids of the fifth group (4). Compounds of neodymium.

G. TEDESCHI: Velocity of dissolution of lead in acids (1).

P. COMUCCI: A singular rock from the Baltoro glacier (Karakoram) (1).

P. PIEPOLI: Observations on the copper pyrites deposits of Champ de Praz in the Valle d'Aosta.

M. FEDELE: Further remarks concerning the non-existence of a peripheral nervous system in Tunicata.

A. VECCHI: Observations on the gonads of sterile and masculinized hybrid hen-pheasants.

A. DE NIEDERHÄUSERN: Influence of a tropical climate on the consumption of oxygen during working.

Forthcoming Events

[*Meetings marked with an asterisk are open to the public.*]

Monday, January 31

UNIVERSITY OF LEEDS, at 5.15.—Dr. H. Jeffreys: "Scientific Method".*

Wednesday, February 2

IMPERIAL COLLEGE OF SCIENCE (ROYAL COLLEGE OF SCIENCE), at 5.30.—Dr. F. Walker: "The Geology and Scenery of the West Indies" (Swiney Lectures. Succeeding lectures on February 4, 7, 9, 11, 14, 16, 18, 21, 23, 25 and 28).*

ROYAL SOCIETY OF ARTS, at 8.15.—C. J. Galpin: "World Air Routes".

Thursday, February 3

CHEMICAL SOCIETY, at 5.—Discussion on "Associated Liquids" to be opened by Prof. J. D. Bernal, F.R.S.

BIRKBECK COLLEGE, LONDON (Natural History Society), at 8.—Prof. T. G. B. Osborn: "Australian Vegetation from the Centre to the Sea".*

Friday, February 4

ROYAL INSTITUTION, at 9.—Prof. E. J. Salisbury, F.R.S.: "The Plants of the Sand Dunes and why they grow there".

Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

EXAMINER in the Aeronautical Inspection Directorates Test House, Kidbrooke, S.E.3—The Secretary (S.2.d.), Air Ministry, Adastral House, Kingsway, W.C.2 (February 5).

LECTURER IN BACTERIOLOGY in the University of Aberdeen—The Secretary (February 18).

HEAD OF THE CHEMISTRY AND BIOLOGY DEPARTMENT, and VICE-PRINCIPAL of the Portsmouth Municipal College—The Registrar (February 19).

NON-PROFESSIONAL ASSISTANT (bacteriology) in the Public Health Laboratory of Northumberland County Council—The County Medical Officer, County Hall, Newcastle-upon-Tyne, 1 (February 21).

PROBATIONARY ASSISTANT ENGINEERS in the Post Office Engineering Department—The Secretary, Civil Service Commission, Burlington Gardens, W.1 (March 3).

Reports and other Publications

(*not included in the monthly Books Supplement*)

Great Britain and Ireland

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1781 (2702): Measurement of the Water Resistance of a 1/24 Scale Singapore IIc Hull. By J. L. Hutchinson. Pp. 14. 2s. 6d. net. No. 1783 (2032 and 1937): Note on the Whirling of Radial Engines on their Mountings; Mathematical Analysis and Experimental Observations. By B. C. Carter. Pp. 25. 3s. 6d. net. No. 1784 (2604): Tests of the N.A.C.A. 11-A Model Hull in the R.A.E. Seaplane Tank. By L. P. Coombes and F. G. Brown. Pp. 12. 2s. net. No. 1785 (2715): Comparison of Results of Tests of the Singapore IIc Model Hull in Five Tanks. By Dr. J. P. Gott. Pp. 16. 2s. 6d. net. No. 1789 (2958): Tests on Rivets and Backward-Lapped Joints, in the Compressed Air Tunnel. By D. H. Williams and A. F. Brown. Pp. 6. 1s. 3d. net. No. 1790 (2914): The Influence of End Constraint on the Torsional Stiffness of a Rectangular Section Tube. By J. C. K. Shipp. Pp. 7. 1s. 3d. net. No. 1791 (2865): The Development of a High Speed Induced Wind Tunnel of Rectangular Cross-Section. By A. Bailey and S. A. Wood. Pp. 16. 2s. 6d. net. (London: H.M. Stationery Office.) [51

Battersea Polytechnic. Report of the Principal for the Session 1936-37. Pp. 35. (London: Battersea Polytechnic.) [61

Ministry of Health. Sanatoria: List of Sanatoria and other Residential Institutions approved by the Minister of Health for the Treatment of Persons suffering from Tuberculosis and resident in England and Wales, with the Names of the Administrative Counties and County Boroughs in which the Institutions are Situate. (List 10f.) Pp. 28. (London: H.M. Stationery Office.) 6d. net. [61

Public Social Services (Total Expenditure under certain Acts of Parliament.) (Cmd. 5609.) Pp. 20. (London: H.M. Stationery Office.) 4d. net. [61

Other Countries

Transactions of the San Diego Society of Natural History. Vol. 8, No. 27: A New Snake of the Genus Sonora from Mexico. By Laurence M. Klauber. Pp. 363-366. Vol. 8, No. 28: A New Sea-Urchin from the "Oligocene" of Oregon. By Hubert Lyman Clark. Pp. 367-374+plate 24. Vol. 8, No. 29: An Extinct Puffin from the Pliocene of San Diego, California. By Prof. Loye Miller. Pp. 375-378. Vol. 8, No. 30: An Upper Pleistocene Fauna from the Baldwin Hills, Los Angeles County, California. By George Willett. Pp. 379-406+plates 25-26. (San Diego, Calif.: San Diego Society of Natural History.) [51

Memoirs of the Kyancutta Museum. No. 4: Further Notes on Archaeocyathinae (Pleosponga) from the Lower Cambrian of South Australia. By R. and J. Bedford. Pp. 27-38+plates 27-41. (Kyancutta: Kyancutta Museum.) [61

Scientific Reports of the Imperial Agricultural Research Institute, New Delhi, for the Year ending 30th June, 1937; with a Brief Survey of Three Decades of Research at the Institute. Pp. iv+177+8 plates. (Delhi: Manager of Publications.) 3 rupees; 5s. 3d. [51

Bulletin of the Madras Government Museum. New Series, General Section, Vol. 2, No. 4: Social and Physical Anthropology of the Nayadis of Malabar. By A. Aiyappan. Pp. iv+141+12 plates. (Madras: Government Press.) 3.2 rupees. [51

New Zealand: Department of Lands and Survey. Annual Report on Public Domains and National Parks of New Zealand. Pp. 8. (Wellington: Government Printing Office.) 6d. [51

League of Nations: Convention for Limiting the Manufacture and Regulating the Distribution of Narcotic Drugs of 13th July, 1931. Estimated World Requirements of Dangerous Drugs in 1938. Statement issued by the Supervisory Body under Article 5. (Official No.: C. 544. M. 381. 1937. XI.) Pp. 60+4. (Geneva: League of Nations; London: George Allen and Unwin, Ltd.) 2s. 6d. [51

Annalen van de Sterrewacht te Leiden. Deel 18, Stuk 2: Photographic Measurements of the Six Double Stars η Cassiopeiae, γ Virginis, ζ Bootis, 44i Bootis, σ Coronae borealis, 70 Ophiuchi, and the Computation of their Orbits with special attention to these Measurements. By K. Aa. Strand. Pp. 138. (Leiden: Sterrewacht.) [51

U.S. Department of Agriculture. Circular No. 452: Experiments with certain Copper Compounds as Bunt Fungicides. By O. A. Nelson and R. W. Leukel. Pp. 8. 5 cents. Leaflet No. 132: Den Hunting as a Means of Coyote Control. By Stanley P. Young and Harold W. Dobyns. Pp. 8. 5 cents. Leaflet No. 146: Bedbugs. By E. A. Back. Pp. 8. 5 cents. Leaflet No. 149: Silverfish. By E. A. Back. Pp. 4. 5 cents. (Washington, D.C.: Government Printing Office.) [51

Bulletin of the American Museum of Natural History. Vol. 74, Art. 2: Interrelationships of the Elasmobranchs with a Key to the Order Galea. By E. Grace White. Pp. 25-138+51 plates. (New York: American Museum of Natural History.) [51

League of Nations. Handbook of International Organisations (Associations, Bureaux, Committees, etc.). Pp. 491. (Geneva: League of Nations; London: George Allen and Unwin, Ltd.) 12s. 6d. [51

Journal of the Faculty of Agriculture, Hokkaido Imperial University. Vol. 42, Part 1: A Contribution to the Knowledge of the Braconid Fauna of the Empire of Japan. By Chihisa Watanabe. Pp. 188+5 plates. (Tokyo: Maruzen Co., Ltd.) [51

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